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ANALYSIS OF THE IOWA PLACEMENT TESTS[1]

T. A. LANGLIE

University of Minnesota

This paper presents a detailed statistical analysis of the results secured from giving the Iowa Engineering Placement Tests[2] and the Minnesota Intelligence Tests to freshmen entering the College of Engineering and Architecture, University of Minnesota, in September, 1924. This analysis aims, by the use of partial correlation technique, to reveal the factors common to all the tests, those factors definitely related to specific tests, and the extent to which the concept of "aptitude test" and "training test" is justified.[3]

STATEMENT OF PROBLEM

The specific questions to be answered in determining the relationship of these tests to one another, are:

1. What degree of correlation, zero order, exists between each placement test and every other placement test?
2. What degree of correlation remains between these tests when intelligence test scores are partialled out?
3. What correlation is there between each placement test and intelligence test scores?
4. What degree of correlation remains between each training

[1] The writer is deeply indebted to Prof. Donald G. Paterson for painstaking guidance and advice throughout this study.

[2] Iowa Placement Tests, composed of an "aptitude" and a "training" test in English, Mathematics, and Chemistry. Hereafter, in this paper, placement tests refer to all of the examinations and training or aptitude tests refer to the specific type of examination.

[3] Access to the data of these tests was obtained through the kindness of Dean O. M. Leland of the College of Engineering, University of Minnesota.

test and intelligence when the corresponding aptitude test is constant, and between each aptitude test and intelligence when the mated training test scores are partialled out?

Answers to these questions will reveal the nature of the several tests and at the same time will indicate the extent to which we may properly label one type of test "training" and the other type "aptitude."

METHOD OF PROCEDURE

The tests used in this study are the 1924 series published by the State University of Iowa, entitled "Iowa Placement Examinations," constructed under the direction of Seashore, Ruch, and Stoddard.

In an article entitled, "College Placement Examinations,"[4] Seashore stated, in part, that "the natural sequel to intelligence tests at college entrance is the placement examination. This examination will differ from an intelligence test primarily in the following respects:

"1. It will be devoted to a single subject or field of knowledge such as English, Mathematics, or Chemistry.

"2. It will differentiate between training in a subject and natural aptitude or fitness for that field of work."

The following descriptive material will serve to indicate the nature of the attempted distinction. The "training tests" are content examinations designed to measure present attainment in the several subjects. The "aptitude tests" are designed to measure ability to solve problems in particular fields.

For example, the English training test contains tests of spelling, punctuation, sentence structure, grammar, clearness, emphasis, and force, whereas the English aptitude test is composed of problems designed to measure a person's ability to comprehend and apply rules, ability to secure correct ideas from English text-book material, reading comprehension, and literary appreciation. The Mathematics training test is an examination in the fundamentals of arithmetic, algebra, and

[4] C. E. Seashore. College Placement Examinations. School and Society, vol. xx, no. 515, Nov. 8, 1924.

geometry, while the Mathematics aptitude test contains arithmetic and algebraic number series, tests of constructive imagination, pure and mathematical logic, and tests of mathematical reading comprehension. The Chemistry training test samples knowledge of fundamental chemical processes, such as valence, formulae, and equations, and knowledge of fundamental manufacturing processes. Its mated aptitude test includes the simple arithmetic of chemistry, chemistry reading comprehension, and general chemical information.

At the beginning of the fall quarter of 1924, these six tests were given to all freshmen registered in the English, Mathematics, and Chemistry classes in the College of Engineering and Architecture. They were administered by faculty members of the college under uniform conditions. All entering freshmen had previously taken the University of Minnesota battery of Intelligence Tests, administered by Professor Donald G. Paterson. All scoring was done by hired clerical assistants and was entirely objective. Scoring was checked where necessary and errors almost entirely eliminated. Test scores made by women, negroes, and foreign born freshmen were excluded from this data and complete records in the placement and intelligence tests were obtained for two hundred and forty-one freshmen, which group forms the basis of this study. This group is a homogeneous body of freshmen, coming for the most part from Minnesota High Schools, all between sixteen and twenty-four years of age, mainly about eighteen or nineteen, and generally typical of freshmen classes in the College of Engineering and Architecture.

RESULTS AND DISCUSSION

The following results and the conclusions drawn therefrom are based on the following assumptions:

1. High coefficients of correlation between scores of any two tests indicate similarity of measurable factors, while low coefficients argue dissimilarity of content, provided all tests have high reliability or consistency coefficients.

2. "Intelligence" is considered to be measured by the Minne-

sota battery of Intelligence Tests. These tests, five in number, include a completion test, a hard opposites test, an arithmetical and a linguistic reasoning test, and a difficult collegiate vocabulary test. For the purposes of this paper they are treated as a unit, having been weighted to make the best possible prediction of total scholarship for the first quarter.[5]

3. High coefficients of correlation between any placement test and the intelligence test indicates that the placement test measures general intelligence, while low correlations indicate

TABLE 1

*Means and sigmas of test scores**

$n = 241$

TEST	INTELL.	EA	ET	MA	MT	CA	CT
Mean	10.60	40.42	95.90	32.28	53.61	77.40	69.70
Sigma	±2.00	±5.64	±14.15	±7.30	±9.57	±6.74	±18.65
Coeff. of Var.	0.19	0.14	0.15	0.23	0.18	0.09	0.27

* Test names are abbreviated for convenience as follows:
EA—English aptitude test.
ET—English training test.
MA—Mathematics aptitude test.
MT—Mathematics training test.
CA—Chemistry aptitude test.
CT—Chemistry training test.
Intell.—University of Minnesota Intelligence Test.

that the placement test measures a unique factor, different from general intelligence, provided, again, that the reliability of the test is high.

The validity of the conclusions based on the results given below depend in large part on the soundness of the foregoing assumptions.

Table 1 presents the means, standard deviations, and coefficients of relative variability of the seven tests. These indices, except the intelligence test score, are the raw scores, i.e., total number of questions answered correctly in each case. The intelligence test index is a composite, as explained above.

[5] H. A. Toops, Multiple Correlation Ratio Method, unpublished.

An inspection of the variability of these different tests reveals that there are important differences among them. Chemistry training has about three times the variability of Chemistry aptitude.

The great variability of the Chemistry training test may be accounted for in part by a tendency to bimodality, a small mode appearing at the lower end of the scale. This is a minor cause, however, as the actual range is large, extending roughly from 10 to 105, whereas the Chemistry aptitude test ranges from 35 to 90. Consequently, chance errors will affect correlations with the aptitude test more than with the training test. There are no significant differences among the other tests, measures of variability being much the same, but the Mathematics tests have a slightly greater variability than the English tests. Judging from variability alone, as related to the central tendency in each case, it is safe to say that the Chemistry training test is the best for diagnostic purposes, chance errors being of less significance in this test than in any other. These variabilities should be considered in studying the following coefficients of correlation, as they are largely interdependent.

Table 2 presents the intercorrelation coefficients, zero order, of the six placement tests. It is interesting to note that aptitude and training tests in any single subject have fairly high correlation coefficients. English aptitude correlates +0.51 with English training; Mathematics aptitude and Mathematics training correlate +0.70; and the two Chemistry tests yield a coefficient of +0.52. The aptitude tests also have fairly high intercorrelations; English and Mathematics yield +0.52; English and Chemistry +0.48; and Mathematics and Chemistry +0.53. The training tests, given in the same order correlate +0.43, +0.25, and +0.47. At the bottom of the table are the averages of the coefficients of correlation of each test with the other tests, thus, the aptitude tests have average correlations of +0.44, +0.52, and +0.51, for English, Mathematics, and Chemistry, respectively. The training tests, given in the same order, correlate +0.41, +0.53, and +0.38. To make clear what these coefficients indicate, intelligence

TABLE 2

Intercorrelation coefficients of the placement tests

$n = 241$

	EA	ET	MA	MT	CA	CT
EA		+0.51 ±0.032	+0.52 ±0.032	+0.44 ±0.035	+0.48 ±0.034	+0.25 ±0.041
ET	+0.51 ±0.032		+0.47 ±0.034	+0.43 ±0.036	+0.38 ±0.037	+0.25 ±0.041
MA	+0.52 ±0.032	+0.47 ±0.034		+0.70 ±0.022	+0.53 ±0.031	+0.39 ±0.037
MT	+0.44 ±0.035	+0.43 ±0.036	+0.70 ±0.022		+0.62 ±0.027	+0.47 ±0.034
CA	+0.48 ±0.034	+0.38 ±0.037	+0.53 ±0.031	+0.62 ±0.027		+0.52 ±0.032
CT	+0.25 ±0.041	+0.25 ±0.041	+0.39 ±0.037	+0.47 ±0.034	+0.52 ±0.032	
Average	0.44	0.41	0.52	0.53	0.51	0.38

TABLE 3

Intercorrelation coefficients of the placement tests with intelligence test scores partialled out

	EA	ET	MA	MT	CA	CT
EA		+0.25 ±0.041	+0.24 ±0.041	+0.17 ±0.042	+0.21 ±0.042	+0.009 ±0.043
ET	+0.25 ±0.041		+0.16 ±0.042	+0.15 ±0.042	+0.05 ±0.043	+0.003 ±0.043
MA	+0.24 ±0.041	+0.16 ±0.042		+0.54 ±0.031	+0.25 ±0.041	+0.18 ±0.042
MT	+0.17 ±0.042	+0.15 ±0.042	+0.54 ±0.031		+0.43 ±0.036	+0.31 ±0.039
CA	+0.21 ±0.042	+0.05 ±0.043	+0.25 ±0.041	±0.43 ±0.036		+0.37 ±0.038
CT	+0.009 ±0.043	+0.003 ±0.043	+0.18 ±0.042	+0.31 ±0.039	+0.37 ±0.038	
Average	0.18	0.12	0.27	0.32	0.26	0.18

test scores have been partialled out of each index, leaving the coefficient of correlation between the placement tests, with intelligence held constant. These coefficients are presented in table 3.

When intelligence is partialled out each coefficient drops decidedly, but the loss is not uniform in each case. The correlations between two tests in a single subject hold up fairly well, being +0.25 for English, +0.54 for Mathematics, and +0.37 for Chemistry. These are drops of 26, 16, and 15 points respectively. In other words, the English tests lose considerable in correlation when intelligence is held constant, which means that each test in English measures general intelligence as well as particular "aptitude" or "training" for English. This is demonstrated later, and is not surprising because of the linguistic nature of the Intelligence tests themselves. The Mathematics and Chemistry tests, while they lose some when intelligence is partialled out, yet retain considerable in common that is not general intelligence. This also is further demonstrated later. Intercorrelations of training and of aptitude tests show decided differences. When intelligence is held constant the aptitude tests yield intercorrelations of +0.24, +0.21, and + 0.25 for English-Mathematics, English-Chemistry, and Mathematics-Chemistry, respectively. These represent decreases of 28, 27, and 28 degrees in the order given above. The training tests drop to +0.15 for English and Mathematics, 0.00 for English and Chemistry, and +0.31 for Mathematics and Chemistry. These represent losses of 28, 25, and 16 units respectively. It is evident from these figures that English training and Chemistry training find all their correlation in the common factor of general intelligence. Otherwise, they are entirely different from each other. While the actual losses in correlation between the aptitude and the training tests in English and Mathematics and in English and Chemistry are almost identical in terms of the coefficient of correlation, yet the aptitude tests actually lose more. They drop respectively from +0.52 and +0.48 to +0.24 and +0.21, while the training tests drop from +0.43 and +0.25 to +0.15 and 0.00, respect-

ively. The difference between +0.52 and +0.24 is greater than the difference between +0.43 and +0.15. In terms of the alienation coefficient[6] these differences are 12 per cent and 9 per cent of the respective standard deviations when used for purposes of prediction. Such a difference is not important except to indicate that equal losses in the correlation index mean different things according to their position on the scale. In these terms, the difference between the English and Chemistry tests of aptitude and training are more noticeable. The aptitude tests in English and Chemistry drop from a coefficient of +0.48 to +0.21, a difference of 10 per cent, in terms of the coefficient of alienation. The mated training tests drop from +0.25 to 0.00, a difference in terms of the coefficient of alienation of only 3 per cent. Apparently when intelligence is partialled out the aptitude tests lose more in correlation value with each other than do the training tests. This means that the training tests measure unique factors to a greater extent than do the aptitude tests. The average of the intercorrelation of each test with the others presents nothing particularly significant. They are all markedly lower when intelligence is held constant, but no decided differences are revealed. The degree of correlation between the Mathematics and Chemistry tests is interesting. Zero order correlations (table 2) are +0.62 and +0.47 for Mathematics training with Chemistry aptitude and Chemistry training, respectively, while Mathematics aptitude correlates +0.53 and +0.39 with the aptitude and training tests in Chemistry, respectively. These correlations drop to +0.43 and +0.31 for Mathematics training, and +0.25 and +0.18 for Mathematics aptitude when intelligence is constant. The high degree of correlation between these tests is no doubt due to the similarity of structure of the Mathematics training and Chemistry aptitude and training tests. The aptitude tests correlate highly because they measure general intelligence and have similar structural content. Finally, it appears from tables 2 and 3 that there are three factors in these several tests: intelligence, particularly in the aptitude tests and the

[6] $\sqrt{1 - r^2}$.

English training test; particular aptitudes, especially mathematical as distinct from general intelligence; and mathematical and chemical training. These conclusions are further emphasized by table 4.

Table 4 presents the zero order coefficients of correlation of each placement test with the intelligence test scores. It also presents coefficients of correlation of each placement test with intelligence, partialling out the mated placement test. Thus English aptitude and intelligence correlate +0.58 and drop to +0.40 when English training scores are constant. This indicates that a high degree of correlation remains between this

TABLE 4

Correlation of Placement Test scores with Minnesota Intelligence Test scores zero order, and with the mated Placement Test scores partialled out.

$n = 241$

TEST	r WITH INTELL.		TEST	r WITH INTELL.	
	Zero order	Training test constant, first order partial		Zero order	Aptitude test constant, first order partial
EA	+0.58±0.029	+0.40±0.037	ET	+0.59±0.029	+0.37±0.038
MA	+0.63±0.026	+0.40±0.037	MT	+0.56±0.030	+0.21±0.042
CA	+0.59±0.028	+0.48±0.034	CT	+0.42±0.036	+0.16±0.042
Average.	+0.60	+0.43	Average.	+0.52	+0.25

aptitude test and intelligence when training is ruled out. Again, English training and intelligence correlate +0.59, dropping to +0.37 when the aptitude test is constant. A similar conclusion follows; English training and intelligence retain a fair degree of correlation when aptitude is partialled out. A slight suggestion is present that English aptitude and intelligence are more closely related than are intelligence and English training, since partialling training lowers the correlation from +0.58 to +0.40, only 18 points, while with aptitude constant the coefficient falls from +0.59 to +0.37, or 22 degrees.

From tables 2 and 3 we see that the two English tests correlate +0.51, zero order, and +0.25 with intelligence constant, a drop of 26 points. Seemingly, then, intelligence is the most important factor present in the three tests, but English aptitude and English training are present as particular factors, the latter slightly more so than the former.

The Mathematics and Chemistry tests show somewhat different results. The aptitude test in mathematics correlates +0.63 with intelligence and falls 23 degrees to +0.40 when its mated training test is held constant. This indicates that intelligence and aptitude for mathematics are correlated to a fair degree, and it also means that training in mathematics is also related to both intelligence and aptitude for mathematics. The training test correlates +0.56 with intelligence and it drops 35 points when aptitude is held constant. Evidently most of the relationship between mathematics training and intelligence is due to the mutual relationship of each of these tests to mathematics aptitude. Tables 2 and 3 sustain this conclusion, since the two mathematics tests correlate +0.70, zero order, dropping only 16 points to +0.54 with intelligence constant. Here then we have a common factor of general intelligence, and a unique factor of training in mathematics. In other words, a mathematics training test plus an intelligence test would measure practically all that is measured by a training test and an aptitude test in mathematics. The same conclusions are equally true of the Chemistry tests as related to intelligence.

The average of the coefficients of correlation for aptitude tests with intelligence is +0.60, zero order, and +0.43 when training tests are constant. The training tests have an average coefficient of correlation with intelligence of +0.52, zero order, and +0.25 when the aptitude tests are partialled. It follows that the aptitude tests and intelligence tests are closely related, while the training tests and intelligence tests measure different factors.

THE QUESTION OF RELIABILITY

The group of freshmen on whom this study is based was a homogeneous group. Distribution of scores in each test

approached normality, except for the test in Chemistry training, which was very slightly bimodal, having a small mode at the lower end of the scale. This mode was almost insignificant, however, and its effect probably negligible. The size of this group is fairly satisfactory and is probably typical, since it encompassed practically the entire entering freshman class in the College of Engineering and Architecture.

A limitation on this study enters in because of the time of giving the placement tests. They were not given at the first meeting of the several classes but two weeks after the first meeting, in which time considerable reviewing of the fields of the tests was possible. The effect of that delay is not measurable until the tests are given again on the first meeting of the several classes. However, the effect of such review is probably not serious, each student having the same advantage as every other. It may have accentuated existing differences, but for purposes of this particular study that would not be serious.

The Minnesota Intelligence Tests have reliabilities around +0.90[7] and combined as they were for this paper, their reliability is satisfactory. The actual reliability of the placement tests is not known, and the type of question used very largely—true-false, right-wrong, etc.—leads one to hesitate to give these tests an index of reliability. It has been demonstrated that the true-false type of question is not very reliable unless about two hundred items are included,[8] but a reliability of +0.75 or +0.80 is a conservative estimate for the total test score, since other more reliable types of questions are also included. More reliable results would be obtained with more reliable tests, but the differences between the two kinds of test, aptitude and training, are great enough to be safely demonstrated for this group.

The tests used are the first edition and are tentative only.

[7] Self Correlation.

[8] G. M. Ruch. The Improvement of the Written Examination. Published by Scott, Foresman Co., N. Y., 1924. pp. 114–120.

Donald G. Paterson and T. A. Langlie. Empirical data on the scoring of true-false tests. Journal of Applied Psychology, vol. ix, no. 4, Dec., 1925.

Experimenting will no doubt lead to improvements in reliability and validity. This study, accordingly, is limited in application because of the uncertainty of both reliability and validity, but the results as given are noteworthy as applied to these particular tests, and very probably to other tests which attempt to distinguish particular aptitudes and abilities.

GENERAL SUMMARY AND CONCLUSION

1. The tests under consideration do differentiate fairly well, except the Chemistry aptitude test with its coefficient of variability of 0.09.

2. Each test is dependent to a fair degree upon general intelligence, particularly the aptitude tests.

3. A particular aptitude is dependent upon training in that particular line.

4. Mathematics training and Chemistry training as measured by these tests have considerable in common, presumably training in Mathematics.

5. The training tests in Mathematics and Chemistry are different from intelligence and aptitude tests.

6. Finally, we may conclude that the factors measured by these tests are:

a. General intelligence, as measured by tests in current use;

b. Training in particular subjects, especially Mathematics and Chemistry; and

c. Mathematical aptitude (which may be termed intelligence plus training in Mathematics).

The third factor is enumerated because it shows up in the Chemistry tests as well as in the Mathematics tests, due to their construction. These tests differ markedly from the English tests, particularly from the English training test.

There seems to be no real differentiation between "aptitude" and "training" in any of these particular subjects, aptitude being general intelligence plus training. It appears that a good intelligence test plus the three training tests will measure every factor that the six placement tests together measure, namely, general intelligence and particular achievements.

A MEASUREMENT OF SOCIABILITY

A. R. GILLILAND AND RUTH S. BURKE
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The tests described here have been devised to measure the social intelligence or sociability of an individual. The sociable individual may be defined as the individual who has the ability to get on agreeably with his fellow men, who is inclined or adapted for society, who is friendly and above all easy to talk to. He is companionable and fond of mingling with others; he seems to enjoy people and likes to be with them and to talk to them much of the time. In short, he is the type of individual we call a "good mixer." It is not necessarily to be inferred from these brief comments that sociability is a unit trait; it may be, or it may be a combination of several traits. Whether it is a single trait or a combination of several traits makes no more difference for this test than the similar problem which arises in the measurement of intelligence.

There are four parts to this test; three are made with photographs and the fourth is a questionnaire. The first photographs test, which in the future will be referred to as the "recognition test," was made with fifty photographs. The following directions were given to the observers: "Twenty photographs are to be successively shown to you on the screen and you are to look at them the first time they are run through; do not write anything; look at them this time with the intention of recognizing as many as possible of the twenty when they are presented to you a second time. At the second presentation these twenty will be mixed with thirty additional photographs which you have not seen before. When you recognize a photograph, record the number of that one under the legend "recognized" on your paper, write the numbers of those you do not recognize under the legend "not recognized." You will have

the numbers beginning with one and ending with fifty recorded when the experiment is completed."

In scoring the papers of the "recognition test," each correctly recognized photograph received the mark of 5 per cent, thus if the entire twenty pictures were recognized the observer received a grade of 100 per cent. However, if such photographs as had not been included in the first twenty presented, were recorded under the word "recognized," the score of 5 per cent was deducted for each one. This was deemed advisable because some of the observers recorded more than twenty numbers in the "recognized" column, presumably in the hopes that among the numbers included, the twenty correct ones would be found, thereby insuring a grade of 100 per cent. It may be said though, for the most part very few did include more than twenty numbers in the "recognized" column; this would tend to indicate that very little guess work went on in the experiment.

The photographs included in these tests were selected from a college annual. They were selected upon the basis of uniformity of shades and sizes of the photographs. No photographs of persons who were in any way unusual in appearance were included in these experiments. All the photographs were presented to the observers as a group by means of a projection lantern; approximately five seconds were allowed for each exposure. The "recognition" test is based on the assumption that the more sociable observers will recognize a larger number of photographs than will the less sociable.

The second photographs test is made up of ten "similar" photographs and will be referred to as the "similars test." It is so called because the ten pictures used are "similar," that is, they are of the same kind as described in the "recognition test," all of them being of men between the ages of twenty and thirty. The following directions were given to the observers: "Ten people are to be introduced to you by their photographs on the screen. The name, the occupation of the individual, and the city in which he lives will be given orally at the same time the photograph appears. The introduction in every case will be

made twice. For example (as trial picture appears on the screen), "Mr. Gilmore, athletic director from Cleveland; Mr. Gilmore, athletic director from Cleveland." Ten pictures will be run through in this manner. The first time they are presented, you are to look at them and remember in so far as possible who each one is, where he is from and what his occupation is; do not write anything. At the conclusion of this part of the experiment, these ten photographs will be re-presented in a different order. When each picture appears, you are to write down the name, occupation and city of those individuals whom you are able to recall."

The purpose in using this experiment is again based on the assumption that the more sociably inclined observers will be able to recall the greater number of people presented, their occupations and home cities.

The third photographs test, the "dissimilars test," is thus termed because there are ten photographs of the same kind as described in the "recognition test," but they are dissimilar in that they are of both men and women ranging from twenty to eighty years of age. Of course not all varieties and classes of people were included since these photographs were also selected from a college annual. Ten different occupations are represented in the titles for this group, however, ranging all the way from farmer to librarian and doctor to detective.

The method of scoring both the "similars" and the "dissimilars" photographs tests is as follows: 10 per cent is given for each photograph making a total of 100 per cent for the ten photographs if all the answers are correct. In each case if the name only is given correctly a score of 4 per cent on the question is recorded. A score of 4 per cent is also given for each correct occupation, and a score of 2 per cent for each correctly named city.

The fourth measurement of sociability was a questionnaire composed of certain questions which, in the opinion of the writer, seemed to be indicative of sociability as evidenced in the college student. In so far as possible, each question was of a quantitative rather than a qualitative nature. In order to

TABLE FOR SCORING THE QUESTIONNAIRE

QUESTION	SCORES														
	0	1	1½	2	2½	3	4	5	6	7	7½	8	9	10	12	12½	15
1. How many intimate friends have you, etc.	0	1		2		3–5	6–10	11–more									
2. How many ordinary friends have you, etc.				0–49			50–199		200–599			600–1000		1001–more			
3. How many speaking acquaintances have you				0–199			200–499		500–599			1000–1499		1500–more			
4. How many dances do you attend during college year	0			1–6			7–15		16–30			31–65		66–more			
5. How many social gatherings, etc.						1–24			25–74				75–149		150–249		250–more
6. During your leisure do you enjoy being with other people	e*				d*			c*			b*			a*			
7. Do you like public speaking	e*				d*			c*			b*			a*			
8. Do you enjoy participating in dramatics	e*				d*			c*			b*			a*			
9. How many personal letters other than from your family do you receive a week		1		2		3–4	5–8	9–more									

10. How many times a semester do you go to the theater.....	0	1	2–5	6–10	11–20	21–more							
11. How many times a month do you go to the movies.....	0	1	2–3	4–7	8–14	15–more							
12. Do you enjoy meeting new people.....	e*	d*	c*		b*	a*							

*a, = most, very much, etc.; b = large part, quite well, etc.; c = some, fairly well, etc.; d = very little, not very well; e = not at all.

Note: This method of scoring was determined upon by an analysis of the reports of thirty students.

determine a satisfactory method of scoring, the questionnaire was tested out on a class of thirty students and a tentative rating scale constructed from the results thus obtained. In the questions in which numerical answers were involved, no suggestions were given the subjects as to the most common replies. The questionnaire in its original form consisted of seventeen questions but in the scorings twelve questions only were considered, the value of each again being determined by the opinion of the writer. No time limit was set but the observers were asked to work as accurately and quickly as possible.

The questionnaire and the method of scoring is as follows:

THE QUESTIONNAIRE

Name.....

Please answer as accurately as you possibly can the following questions. If you have any comments to make on any of them, do so at the right of the question.

1. How many intimate friends have you? By intimate is meant friends who confide in you. Answer
2. How many ordinary friends have you? By this term is meant friends, whom if you met on the street, you would stop and speak with a moment. Take into consideration friends outside of college mates as well as college mates too. Answer
3. How many speaking acquaintances have you? This group is to be taken entirely separately from groups 1 and 2. Answer
4. How many dances do you attend *during the school year?* Answer
5. How many social gatherings do you attend *during the school year?* This includes all social affairs which are not dances. Answer
6. Check below the answer with which you most nearly agree. During your leisure do you enjoy being with other people
   a. Most of the time
   b. A large part of the time
   c. Some of the time
   d. Very little of the time
   e. Not at all
7. Check below the answer with which you most nearly agree. Public speaking (if you have never done any, check the

way you think that you would feel). Do you like public speaking

a. Very much
b. Quite well
c. Fairly well
d. Not very well
e. Not at all

8. Check below the answer with which you most nearly agree. Dramatics and the like. Do you enjoy *participating* in such

a. Very much
b. Quite well
c. Fairly well
d. Not very well
e. Not at all

9. How many personal letters do you receive a week *other than from your family?* Answer

10. How many times a *semester* do you go to the *theater?* Answer

11. How many times a *month* do you go to the *movies?* Answer

12. Check below the answer with which you most nearly agree. Do you enjoy meeting new people

a. Very much indeed
b. Quite well
c. Somewhat (fairly well)
d. Not very well
e. Not at all

Three classes in psychology at Northwestern University were used as subjects for this experiment. They will be referred to hereafter as Group I, Group II, and Group III. Group I consisted of twenty-seven members of a class in Advanced General Psychology. Group II consisted of forty members of a class in Abnormal Psychology. Group III was composed of twenty-four members of a class in Fields of Psychology.

Ratings in sociability (sociability having been described to the subjects in the same terms as it is defined in the introductory paragraph of this article) were used as a check on the validity of the four sociability tests already mentioned. It is realized that ratings are not as reliable as they might be but unfortunately they are the best single check that has been devised up to the present time. The average of the total ratings was

used for one check. A second check was made by using the average of the ratings assigned by those individuals who were rated highest themselves in sociability, it being claimed by Hollingworth[1] that an individual who possesses a given trait to a high degree is better able to judge that trait in another individual. The observers for the most part were fairly well acquainted, having been in college together for several years. They did not rate anyone whom they did not know.

Form eight of the Army Alpha Intelligence Test was given to each of the observers as well as a rote memory test consisting of thirty common words. The purpose of these tests was to discover whether we were measuring intelligence of the same kind of Army Alpha measures, or if the photographs tests were merely tests in rote memory.

From the data at hand we have come to the following conclusions:

1. The "similar" photographs test does not seem to be a satisfactory measure of social intelligence. In every case the correlation is below 0.27.

2. The "dissimilar photograph test" is a somewhat better test for sociability than the "similars" test, but more data will have to be compiled in order to determine the validity of this specific test. The highest correlations found here were 0.43, 0.37, and 0.34.

3. The "recognition test" is better than either the "similars" or the "dissimilars" photographs tests. For the most part the correlations were 0.25 or higher, two being 0.43 and 0.47.

4. The three photographs tests combined correlate fairly high throughout with the total average ratings. Practically all the correlations were 0.25 or above, the two highest being 0.46 and 0.48.

5. That the four sociability tests as well as the ratings in sociability do not measure the same thing that the Army Alpha measures is shown by the following correlations; 0.10, 0.03, 0.01, and 0.002.

6. The rote memory test was used in Group III only. From

[1] Hollingworth, H. L. Judging Human Character. Chapter IV.

TABLE 1

Correlations obtained from the data of Groups I, II and III between the various sociability tests, intelligence tests and ratings in sociability

In each instance the P.E. is indicated below its corresponding correlation.

	"SIMILARS" TEST			"DISSIMILARS" TEST			"RECOGNITION" TEST			QUESTIONNAIRE			ARMY ALPHA TEST	
For Groups.....	I	II	III	I	II	III	I	II	III	I	II	III	I	II
"Dissimilars" test..	0.41 (0.10)	0.26 (0.09)	0.13 (0.12)											
"Recognition" test.	0.35 (0.10)	0.20 (0.09)	0.05 (0.13)	0.19 (0.12)	0.22 (0.09)	0.11 (0.13)								
Questionnaire.....	0.40 (0.10)	0.15 (0.10)	−0.12 (0.13)	0.36 (0.10)	0.24 (0.09)	−0.16 (0.12)	0.36 (0.10)	0.42 (0.08)	0.21 (0.12)					
Army Alpha Intelligence test.....	0.17 (0.12	0.17 (0.10)		0.30 (0.11)	0.04 (0.10)		−0.26 (0.12	−0.21 (0.09)						
Rote memory test..			0.57 (0.08)			0.05 (0.13)			0.02 (0.13)					
Average ratings of class.....	0.15 (0.12)	0.15 (0.10)	−0.15 (0.12)	0.56 (0.08)	0.30 (0.09)	−0.02 (0.13)	0.37 (0.10)	0.07 (0.10)	0.47 (0.10)	0.60 (0.08)	0.50 (0.07)	0.43 (0.10)	0.002 (0.12)	−0.18 (0.10)
Average of ratings of those rated highest.....	0.10 (0.12)	0.18 (0.09)	−0.32 (0.11)	0.45 (0.09)	0.16 (0.10)	−0.07 (0.13)	0.19 (0.12)	0.19 (0.09)	0.34 (0.11)	0.21 (0.11)	0.48 (0.07)	0.34 (0.11)	−0.07 (0.12)	−0.04 (0.10)

TABLE 2

Correlations obtained from the data of Groups I, II and III between a combination of the various sociability tests and the ratings in sociability, etc.

In each instance the P.E. is indicated below its corresponding correlation.

	QUESTIONNAIRE AND "RECOGNITION" TEST COMBINED			THREE PHOTOGRAPHS TESTS COMBINED			THREE PHOTOGRAPHS TESTS AND QUESTIONNAIRE COMBINED		
For Groups	I	II	III	I	II	III	I	II	III
Average ratings of class	0.58 (0.08)	0.25 (0.09)	0.40 (0.11)	0.48 (0.10)	0.25 (0.09)	0.25 (0.12)	0.57 (0.08)	0.34 (0.09)	0.39 (0.11)
Average of ratings of those rated highest	0.25 (0.11)	0.34 (0.09)	0.32 (0.11)	0.11 (0.12)	0.25 (0.09)	0.08 (0.13)	0.35 (0.10)	0.34 (0.09)	0.19 (0.12)
Questionnaire				0.50 (0.14)	0.41 (0.08)				
Army Alpha				0.10 (0.12)	−0.03 (0.10)				

these limited data we find a correlation of 0.57 between the rote memory and the "similars" test which tends to indicate that after all the "similars photographs test" may be closely related to rote memory. This is not true of the "recognition" test and the "dissimilars" test which correlate 0.02 and 0.05 respectively.

7. The questionnaire is by far the best single method we have devised for measuring sociability. The correlations are uniformly high (in the 0.50 and 0.60 for the most part with the exception of one or two cases). This particular questionnaire is relatively reliable then, in determining sociability as evidenced in the college student; but it has the disadvantage that it cannot be used with groups other than college groups for the questions pertain to college activities.

8. The questionnaire and the "recognition" test combined show fairly high correlation throughout with the ratings in sociability, indicating that a combination of these two tests may prove a reliable measure of that trait.

9. The correlations for Group I are consistently higher and are probably more reliable than for Groups II and III. The students in this group had been in college together longer, were better acquainted with one another and had received more special instruction in methods of rating than the other two groups.

On the basis of the data so far presented we conclude that the present questionnaire is a very reliable measure of sociability in university students. In fact it seems to be a better measure of this trait than the average group test is a measure of intelligence. The "recognition test" is also fairly reliable, and the "dissimilars test" may become more reliable with certain modifications. The three photographs tests combined, and the three photographs and the questionnaire combined likewise make a very reliable measure of social intelligence.

The following changes have been suggested for future study on the problem. First that the questionnaire be revised in order that it may apply to more general groups of individuals rather than to college students only. Second, that the "dissimilars test" and the "recognition test" be revised and modified

to some extent before they can be accepted as definite measures. It may be that more "dissimilarity," so to speak, will make the test more satisfactory than it is at present. With such changes and possibly some others yet to be devised this gives evidence of becoming a very satisfactory test of the kind of intelligence which Thorndike has designated as social intelligence or which we have called sociability.

OPTIMUM DIFFICULTY OF GROUP TEST ITEMS

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THE PROBLEM

General practice in the construction of group tests for the purpose of measuring capacity and attainment seems to favor an inclusion of test items ranging from very easy to very difficult. Certain statistical reasons for this practice may be offered. Published studies on test construction offer little or no empirical data on the subject.

Where tests are used for measurement within groups of people with similar abilities, the range of difficulty of test items tends to be constant. A question arises as to whether this range of difficulty of test items should be wide or narrow. Is there, for instance, an optimum difficulty for test items when used year after year for predictive purposes in closely homogeneous groups? Or we might state the question in another way: Is there a best range of difficulty of test items using predictive value as a criterion?

PROCEDURE

The data used in the present study were secured primarily for the purpose of determining the predictive value of test items occurring in two examinations in common use with college freshmen. The items occur in Thorndike Intelligence Examination, Part I, Forms E and N; and Iowa Content Examination, Form A. The subjects used were two groups of 240 college students chosen from among a larger group of entering freshmen at the Carnegie Institute of Technology.

The subjects were chosen to represent four levels of ability in the freshman class, i.e., upper fourth or superior; above

average; below average; and lower fourth or inferior. Persons were assigned to a particular group on the basis of agreement of three indices, viz., Thorndike Examination score, Iowa Content Examination score, average of freshman scholarship marks. A person was assigned to a given group when it was found that the three indices agreed with each other as to the probable level of ability. Representative groups of 60 each were thus selected for the four levels of ability designated.

A frequency count of right and wrong responses was made for each test item answered by persons in each group of 60. From these frequencies it was possible to determine the relative difficulty of each test item and also to determine the predictive value of each test item.

The criterion of relative difficulty was determined quantitatively by a figure representing the total number of right responses made by the entire group of 240 persons. Omissions were counted as wrong responses except in cases where all the test items were not covered by the individual in the time allotted. In such instances the ratio of right versus wrong responses was determined for the number attempted. This ratio was used to estimate the probable number which would have been right had all the persons reached that point in the examination.

The criteria of predictive value of test items were determined on the basis of efficiency of given test items in distinguishing the groups representing four levels of ability. If a greater number of superior and above average persons gave right responses to a test item than did the below average and inferior, the item was considered to have predictive value.

Two methods of determining quantitative criteria of predictive value were used as a basis for the present study.

Criterion I

R_1 equals right responses—Superior group
R_2 equals right responses—Above average group
R_3 equals right responses—Below average group
R_4 equals right responses—Inferior group

R_1 minus R_2 equals X_1
R_1 minus R_3 equals X_2
R_1 minus R_4 equals X_3
R_2 minus R_3 equals X_4
R_2 minus R_4 equals X_5
R_3 minus R_4 equals X_6

Sum X's equal Differential value I

Criterion II

R_1 minus R_4 equals Y equals Differential value II

The answer to the question of best range of difficulty of test items was sought by making comparisons of the values obtained for degree of difficulty with each of the stated criteria of predictive value.

SIGNIFICANT DATA

The tables which follow contain data which have bearing upon the problem being considered.

The figures at the left of each table represent the difficulty values of test items. The columns to the right are indicated by letters which have the following significance:

Column "N" indicates the number of items in each class interval.
Column "R" indicates the range of predictive values found in each interval.
Column "M" indicates the mean predictive value for each stated interval of difficulty.
Column "D" indicates the rank of each interval on the basis of predictive values shown in column "N."

Tables 1, 2 and 3 present the basic data arranged for ten equally divided class intervals. Tables 4, 5 and 6 present the same data arranged for percentile intervals. Tables 7, 8, 9 and 10 are summaries of data found in preceding tables. Table 11 shows the range of difficulty of five intervals of tables 1 to 6 having the greatest predictive values. Tables 7 to 11 contain summaries of preceding tables.

TABLE 1

Average predictive values of test items in the Iowa Content Examination, Form A—240 subjects—400 items

INTERVAL OF DIFFICULTY	N	R	M	D
		Criterion I		
217–240	27	2 to 36	21.1	8
193–216	58	4 to 93	40.7	6
169–192	66	−9 to 104	49.7	5
145–168	57	2 to 128	60.2	1
121–144	49	−26 to 110	50.5	4
97–120	38	−9 to 114	54.1	2
73–96	44	−27 to 88	50.6	3
49–72	37	−34 to 86	31.3	7
25–48	19	−22 to 53	17.7	9
0–24	5	9 to 21	13.0	10
		Criterion II		
217–240	27	1 to 11	7.1	8
193–216	58	−30 to 29	9.1	6
169–192	66	−2 to 33	16.2	3
145–168	57	−1 to 40	18.7	1
121–144	49	−11 to 57	16.1	4
97–120	38	3 to 32	18.2	2
73–96	44	0 to 31	14.9	5
49–72	37	−12 to 25	8.5	7
25–48	19	−4 to 18	6.8	9
0–24	5	3 to 7	4.8	10

TABLE 2

Average predictive values of test items in Thorndike Intelligence Examination, Part I, Form E, and parts of Form N—240 subjects—236 items

INTERVAL OF DIFFICULTY	N	R	M	D
		Criterion I		
217–240	68	−9 to 51	11.0	9
193–216	50	−7 to 84	27.7	6
169–192	32	−18 to 98	41.5	5
145–168	36	−28 to 125	47.7	4
121–144	17	1 to 131	61.2	2
97–120	12	−3 to 124	60.3	3
73–96	5	30 to 103	65.8	1
49–72	9	−3 to 49	21.3	7
25–48	4	−3 to 17	9.5	10
0–24	3	14 to 15	14.3	8
		Criterion II		
217–240	68	−3 to 20	3.4	9
193–216	50	−3 to 26	9.1	6
169–192	32	−18 to 31	11.6	5
145–168	36	−7 to 37	13.8	4
121–144	17	5 to 37	18.5	3
97–120	12	−3 to 39	18.6	2
73–96	5	10 to 34	21.0	1
49–72	9	−1 to 13	7.1	7
25–48	4	−1 to 6	2.3	10
0–24	3	3 to 5	4.1	8

TABLE 3

Average predictive value of test items in Thorndike Intelligence Examination, 10 tests from Form E, Part 1—480 subjects—109 items

INTERVAL OF DIFFICULTY	N	R	M	D
		Criterion I		
433–480	31	−3 to 67	24.6	8
385–432	24	14 to 136	73.0	5
337–384	10	−21 to 149	69.5	6
289–336	18	−34 to 187	89.5	4
241–288	8	35 to 197	94.5	2
193–240	8	2 to 207	121.6	1
145–192	2	53 to 134	93.5	3
97–144	4	31 to 99	65.7	7
44–96	4	12 to 21	19.5	9
0–48	0			
		Criterion II		
433–480	31	−1 to 30	8.4	8
385–432	24	3 to 43	21.5	6
337–384	10	−7 to 58	26.2	4
289–336	18	−12 to 59	30.6	1
241–288	8	12 to 68	26.0	5
193–240	8	−1 to 60	29.0	3
145–192	2	19 to 42	30.5	2
97–144	4	9 to 32	21.0	7
44–96	4	4 to 10	6.0	9
0–48	0			

TABLE 4

Average predictive values of test items in Iowa Content Examination, Form A—240 subjects—400 items

PERCENTILE INTERVALS	INTERVAL RANGE	R	M	D
		Criterion I		
91–100	(215–238)	2 to 61	26.9	10
81–90	(204–215)	5 to 97	40.5	8
71–80	(191–203)	4 to 113	50.2	6
61–70	(174–190)	9 to 104	52.7	4
51–60	(156–173)	2 to 128	64.2	1
41–50	(135–155)	−26 to 97	50.6	5
31–40	(111–134)	−11 to 114	54.9	2
21–30	(87–110)	−9 to 97	53.1	3
11–20	(62–86)	−27 to 88	41.8	7
0–10	(10–61)	−34 to 82	28.1	9
		Criterion II		
91–100		−11 to 18	7.2	9
81–90		−30 to 29	8.1	8
71–80		−28 to 31	12.5	7
61–70		−27 to 33	15.9	4
51–60		−22 to 40	18.8	1
41–50		−28 to 57	15.5	5
31–40		5 to 31	17.0	2
21–30		−13 to 31	16.1	3
11–20		−4 to 25	13.1	6
0–10		−12 to 18	6.5	10

TABLE 5

Average predictive values of test items in Thorndike Intelligence Examination, Part I, Form E, and parts of Form N—240 subjects —236 items

PERCENTILE INTERVALS	INTERVAL RANGE	R	M	D
		Criterion I		
91–100	(232–240)	−9 to 21	3.7	10
81–90	(225–231)	−4 to 27	11.1	9
71–80	(215–224)	−7 to 51	20.7	8
61–70	(203–214)	4 to 58	24.9	7
51–60	(192–202)	10 to 88	32.8	5
41–50	(175–191)	−18 to 98	37.9	3
31–40	(157–174)	2 to 92	33.1	4
21–30	(138–156)	−4 to 125	60.8	1
11–20	(106–137)	−3 to 131	57.0	2
0–10	(17–105)	−3 to 113	32.3	6
		Criterion II		
91–100		−2 to 7	1.5	10
81–90		−3 to 10	3.2	9
71–80		−3 to 20	6.3	8
61–70		1 to 18	9.0	7
51–60		−1 to 26	9.9	6
41–50		−5 to 31	13.5	3
31–40		−7 to 23	12.1	4
21–30		−1 to 37	18.3	2
11–20		−3 to 36	18.9	1
0–10		−1 to 39	10.5	5

TABLE 6

Average predictive value of test items in Thorndike Intelligence Examination 10 tests from Form E, Part I—480 subjects—109 items

PERCENTILE INTERVALS	INTERVAL RANGE	R	M	D
		Criterion I		
91–100	(463–479)	−7 to 25	7.7	10
81–90	(448–462)	0 to 46	22.7	9
71–80	(432–447)	6 to 66	37.7	8
61–70	(406–431)	14 to 131	60.4	6
51–60	(387–405)	39 to 136	84.2	3
41–50	(340–386)	−21 to 149	73.4	4
31–40	(311–339)	−34 to 160	67.6	5
21–30	(274–310)	35 to 187	104.1	2
11–20	(153–274)	2 to 207	110.2	1
0–10	(55–152)	12 to 134	52.5	7
		Criterion II		
91–100		−2 to 8	2.5	10
81–90		−1 to 30	9.4	9
71–80		6 to 22	12.8	8
61–70		3 to 43	19.8	6
51–60		−12 to 40	24.5	4
41–50		−7 to 58	26.7	3
31–40		−12 to 58	22.1	5
21–30		12 to 59	35.9	1
11–20		−1 to 58	26.9	2
0–10		4 to 32	16.5	7

TABLE 7

Average predictive values

CLASS INTERVAL	AVERAGES, TABLE 1	AVERAGES, TABLE 2	AVERAGES, TABLE 3 (DIVIDED BY 2)	SUM OF THREE AVERAGES	D
			Criterion I		
217–240	21.1	11.0	12.3	44.4	8
193–216	40.7	27.7	36.5	104.9	6
169–192	49.7	41.5	34.7	125.9	5
145–168	60.2	47.7	44.7	152.6	4
121–144	50.5	61.2	47.2	158.9	3
97–120	54.1	60.3	60.8	175.2	1
73–96	50.6	65.8	46.7	163.1	2
49–72	31.3	21.3	32.9	85.5	7
25–48	17.7	9.5	8.7	35.9	10
0–24	13.0	14.3*	10.0	37.3	9
			Criterion II		
217–240	7.1	3.4	4.2	14.7	8
193–216	9.1	9.1	10.7	28.9	6
169–192	16.2	11.6	13.1	40.8	5
145–168	18.7	13.8	15.3	46.8	4
121–144	16.1	18.5	13.0	47.6	3
97–120	18.2	18.6	14.5	51.3	1
73–96	14.9	21.0	15.2	51.1	2
49–72	8.5	7.1	10.5	26.1	7
25–48	6.8	2.3	3.0	11.1	10
0–24	4.8	4.1*	3.0	11.9	9

* Estimated.

TABLE 8

Average predictive values

PERCENTILE INTERVAL	AVERAGES, TABLE 4	AVERAGES, TABLE 5	AVERAGES, TABLE 6 (DIVIDED BY 2)	SUM OF THREE AVERAGES	D
			Criterion I		
91–100	26.9	3.7	3.8	34.4	10
81–90	40.5	11.1	11.3	62.9	9
71–80	50.2	20.7	18.8	89.5	7
61–70	52.7	24.9	30.2	107.8	6
51–60	64.2	32.8	42.1	149.1	3
41–50	50.6	37.9	36.7	125.2	4
31–40	54.9	33.1	33.8	121.8	5
21–30	53.1	60.8	52.0	165.9	1
11–20	41.8	57.0	55.1	153.9	2
0–10	28.1	32.3	26.2	87.6	8
			Criterion II		
91–100	7.2	1.5	1.2	9.9	10
81–90	8.1	3.2	4.7	16.0	9
71–80	12.5	6.3	6.4	25.2	7.5
61–70	15.9	9.0	9.9	34.8	6
51–60	18.8	9.9	12.2	40.9	4
41–50	15.5	13.5	13.3	42.3	3
31–40	17.0	12.1	11.0	40.1	5
21–30	16.1	18.3	17.9	52.3	1
11–20	12.1	18.9	13.4	45.4	2
0–10	6.5	10.5	8.2	25.2	7.5

TABLE 9

Average rank—tables 1 to 3

CLASS INTERVAL	TABLE 1		TABLE 2		TABLE 3		AVERAGE RANK
	Criterion I	Criterion II	Criterion I	Criterion II	Criterion I	Criterion II	
217–240	8	8	9	9	8	8	8.3
193–216	6	6	6	6	5	6	5.8
169–192	5	3	5	5	6	4	4.3
145–168	1	1	4	4	4	1	2.5
121–144	4	4	2	3	2	5	3.3
97–120	2	2	3	2	1	3	2.1
73–96	3	5	1	1	3	2	2.5
49–72	7	7	7	7	7	7	7.0
25–48	9	9	10	10	9	9	9.3
0–24	10	10	8	8	x	x	9.0

TABLE 10

Average rank—tables 4 to 6

PERCENTILE INTERVAL	TABLE 4		TABLE 5		TABLE 6		AVERAGE RANK
	Criterion I	Criterion II	Criterion I	Criterion II	Criterion I	Criterion II	
91–100	10	9	10	10	10	10	9.9
81–90	8	8	9	9	9	9	8.6
71–80	6	7	8	8	8	8	9.1
61–70	4	4	7	7	6	6	5.6
51–60	1	1	4	6	3	4	3.1
41–50	5	5	3	3	4	3	3.9
31–40	2	2	5	4	5	5	3.9
21–30	3	3	1	2	2	1	2.0
11–20	7	6	2	1	1	2	3.1
0–10	9	10	6	5	7	7	7.3

TABLE 11

Ranges of difficulty of five intervals having greatest predictive values as shown by tables 1 to 6—total possible range 0 to 240

		LOWER INCIDENCE MOST DIFFICULT	UPPER INCIDENCE LEAST DIFFICULT
Table 1	Criterion I	73	192
	Criterion II	73	192
Table 4	Criterion I	87	190
	Criterion II	87	190
Table 2	Criterion I	73	192
	Criterion II	73	192
Table 5	Criterion I	106	202
	Criterion II	Between 17 and 105	191
Table 3	Criterion I	73	216*
	Criterion II	73	192*
Table 6	Criterion I	87	190*
	Criterion II	87	190*

* Figures given for tables 3 and 6 were obtained by dividing the actual number by 2 in order to make them comparable with the ranges given for tables 1, 2, 4 and 5.

CONCLUSIONS

1. An optimum specific difficulty for predictive purposes is not indicated by the data presented in this report. The fluctuation of interval ranks shown in column "D" of the various tables would seem to indicate that there is none. There is, however, a best range of difficulty for predictive purposes suggested by the manner in which the data group themselves.

2. If the five intervals having the highest predictive merit are selected from tables 1, 2 and 3, it is found that they cluster around the mean. Some tend away from the mean toward the most difficult end of the scale and others tend away from the mean toward the least difficult end of the scale.

3. The ranges of predictive merit for each class interval shown

in column "R" follow closely the ranks of predictive merit shown in column "D."

4. That the conditions found are not peculiar to one test or examination is indicated by the degree of agreement shown by the summaries in tables 7 and 9.

5. In order to overcome differences in the number included in each class interval, percentile intervals were introduced in tables 4, 5, 6, 8 and 10. The seeming discrepancies in tables 4, 5 and 6, column "D," as compared with tables 1, 2 and 3 disappear upon examination of the lower and upper incidences of the best range of difficulty. This is shown in table 11.

6. Within the limits of the data presented, it appears that the test items having greatest predictive value lie within an area demarked by a point about 30 per cent above the most difficult end of the arbitrary scale and a point about 20 per cent below the least difficult end of the scale. The midpoint of best average predictive value lies near the mean of difficulty but toward the least difficult end of the arbitrary scale.

FREQUENCY OF REPUBLICANS AND DEMOCRATS AMONG EMINENT AMERICANS

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There is considerable agitation among political scientists looking toward the application of the principles and methods of the laboratory sciences toward the understanding of political affairs, and the replacement of speculation and allegation with verifiable facts. There is particular interest in the psychological aspects of political problems[1] and in the use of psychological methods in solving these problems.[2]

One of the most practical of these questions of political psychology is, what are the differences in personnel among the parties? With the end of securing some facts regarding this question the writer made an investigation of the frequency with which adherents of the two major parties, Republican and Democratic, are found among eminent Americans. The source for the data was Who's Who in America (Vol. XIII, 1924–1925). Tabulation was made of 1000 names (men only): the first 500 in the book; and then, in order that results might not be affected by several members of a family whose name begins with A and who might belong to the same party, the second 500 names were taken from the middle of the book, beginning with those whose names begin with N. These 1000 persons, representing approximately one-twenty-third of the men mentioned in the volume, may be regarded as a reliable sampling of the whole.

Upon examining the biographical records of these men one is

[1] Merriam, C. E. The significance of psychology for the study of politics. Amer. Pol. Sc. Rev., August, 1924, 469–88.

[2] Dewey, A. Gordon. On methods in the study of politics. Pol. Sc. Quar., December 1923, 636–651; June, 1924, 218–233.

struck by the fact that a very large number of them do not acknowledge any political affiliation. Of the 1000 examined, 635 or 63.5 per cent do not favor one party with sufficient warmth to warrant saying so. Some may withhold the information for supposedly diplomatic reasons. Many are probably independent voters. Probably the greater number, however, belong to the large group of non-voters who are estimated to number about 50 per cent of the population at large.

TABLE 1

OCCUPATION	PER CENT
Politician	5.7
Writer	14.5
Lawyer	11.4
Engineer	4.1
Educator	17.3
Clergyman	7.8
Scientist	5.6
Physician	6.8
Army and Navy	4.1
Artist	5.5
Miscellaneous	17.2
Total	100.0

One way of accounting for this large number of apparently indifferent persons is to say that they belong to professional groups that are typically uninterested in politics. Some light on this question may be secured from a previously published investigation based on Volume XI of Who's Who.[3] This showed the occupational distribution given in table 1. Among these groups, the writers, engineers, educators, clergymen, scientists, physicians and artists are usually alleged to be uninterested in politics; in the above table they total 65.6 per

[3] Kitson, H. D., and Culbertson, L. The vocational changes of one thousand eminent Americans. Vocational Guidance Magazine, I, March, 1923, pp. 128–130.

cent, about the same number as those in the present investigation who did not express political preference.

There were approximately a score of persons who admitted having been politically active on behalf of Prohibition, Populist and Progressive (1912) parties. Since they were so few they were not tabulated separately, but were included in the 63.5 per cent not expressing preference for the Republican or Democratic parties, and the tabulation was restricted to those persons affiliated with the two major parties. The latter numbered 365, divided between the two parties as follows: Republicans, 253, Democrats, 112. That is, of the eminent

TABLE 2

Popular votes for the Republican and Democratic presidential candidates 1892–1920

YEAR	REPUBLICANS	DEMOCRATS
1892	5,190,802	5,554,414
1896	7,035,638	6,467,946
1900	7,219,530	6,358,071
1904	7,628,834	5,084,491
1908	7,679,006	6,409,106
1912	3,483,922	6,286,214
1916	8,538,221	9,129,606
1920	16,152,200	9,147,353
1924	16,187,878	8,438,272
Total.....	79,116,021	62,875,473

persons in America, who, in their biographies in Who's Who, confess allegiance to one or the other of the two major parties, 25.3 per cent are Republicans and 11.5 per cent, or less than half that number are Democrats. In order for this difference to be statistically significant it should be compared with the numerical difference between Republicans and Democrats in the population at large. It is generally conceded that the former outnumber the latter. By how much, however, can not easily be determined. Perhaps the popular vote in Presidential elections is as good a single measure as may be em-

ployed. This vote during the elections of the past thirty years, the probable span of the political activity of these persons, is shown in table 2.[4]

If these figures indicate approximately the ratio of Republicans and Democrats in the population at large, they show a difference over the past thirty years in favor of the former amounting to 8,490,952, which is 15 per cent larger than the number of Democrats. Among the eminent subjects of this investigation, however, there were 112 Democrats outnumbered by 253 Republicans. The difference is 141, or 126 per cent. It seems almost incontestable, therefore, that there is a marked tendency among eminent men of the country who are politically affiliated, to affiliate with the Republican party rather than the Democratic.

This fact, scientifically established, should now be explained. The explanation can not be a matter of prejudiced speculation or superficial conjecture. It should come rather from further investigation of the men concerned, from correlations between party preference and factors that may bear on it.

In such a complex thing as political preference there are probably several things that would constitute explanatory principles. One may be place of birth and residence. Another may be psychological—the type of mind that makes for eminence may also produce a tendency to be sympathetic with the Republican party. Measures have been made of the intelligence of the inhabitants of various parts of the country. A correlation between such measures and the votes cast in different regions might indicate a relation between intelligence and party affiliation. Whatever be the explanation it should come only in terms of scientifically investigated facts.

From this study in political psychology several significant conclusions emerge: (1) the majority of eminent Americans appear to be politically indifferent; at least, they do not confess party allegiance in their published biographies. If this omission means lack of interest it indicates that the country suffers from lack

[4] Chicago Daily News Almanac and Year-book, 1925.

of political leadership on the part of those who ought to lead, a condition already described in the elaborate study of Non-voting by Merriam and Gosnell.[5] (2) Among the eminent Americans who acknowledged party membership, Republicans are found to be more than twice as numerous as Democrats. (3) The most interesting feature of the investigation is the demonstration that the personnel of political parties can be made a subject for scientific investigation. By means of scientific investigations such as the one here reported, much information may be secured about such questions as: the influence on party choice of place and data of birth; place of residence; political faith of father or husband; occupation, etc. In short, there is reason to believe that by the assiduous application of scientific method, such as is here illustrated, practical and theoretical politics may ultimately be emancipated from the field of speculation and mystery and may be grounded on a basis of facts.

[5] Merriam, C. E., and Gosnell, H. G. Non-Voting, Causes and Methods of Control. Chicago, University of Chicago Press. 1924.

"WANT" AND "SOLUTION" ADVERTISEMENTS

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The writers maintain that there are two major objectives in advertising: first, to make a reader *want*, and second, to present a *solution*, i.e., to show how his desire may be adequately satisfied by means of the advertiser's commodity. The writers maintain further that unless the individual feels a want it is almost useless to discuss the solution. Consequently, making a man want (if he does not already want) is the more fundamental of the two aims and, for the sake of advertising efficiency, should come first.[1]

The validity of this thesis might be established by contrasting experimentally the effectiveness of two sets of advertisements: one designed only to arouse wants, the other only to present the adequacy of the solution. However, as the survey of many advertisements demonstrates, very few advertisements play up only one of these objectives. Thus, to carry out an experiment contrasting these two elements as such would necessitate the preparation of the required advertisements. Such artificial advertisements have been used to good effect by some experimenters. In the present experiment, however, it was deemed better to avoid artificiality and to employ advertisements that have actually appeared in high-priced space. Also, it seemed better to make each advertisement complete as regards the presence of both "want" and "solution" elements, and to contrast the advertisements by contrasting the emphasis these elements received.

Roughly speaking, current advertisements may be classed in three groups: first, those emphasizing primarily the want;

[1] For a complete statement of this proposition, see E. K. Strong, Jr., Psychology of Selling and Advertising, 1925.

second, those emphasizing primarily the solution; and third, those stressing both factors about equally. Since the majority of present day advertisements fall in the second group, examples of "solution" advertisements were easy to obtain. Examples of the first group—"want" advertisements—were far more difficult to find. Indeed, the majority of such specimens as were found had to be tinkered with to some extent to bring them into the first rather than the third group.

This investigation aims to measure the relative merit of stressing the "want" or the "solution" element in advertising, the effectiveness of each type being determined by the extent to which it makes memorable a trade-name. The investigation centers around forty advertisements, of which twenty emphasize the want element and twenty the solution element. The problem is not to measure the relative effectiveness of these two elements *as such*, but rather to measure the relative effectiveness of *two groups of advertisements* in both of which both elements appear, but with *contrasting* instead of equal emphasis. If significant differences are found under such conditions, it would seem that greater differences must be obtained if the two elements be definitely and precisely contrasted.

In the case of the ten advertisements reproduced below the trade-name appears on the average 3.3 times in the "want" advertisements and 4.5 times in the "solution" advertisements; and more space is devoted to describing the trade-named commodity in the latter group than in the former. This condition is characteristic of the entire forty advertisements used in the study. Now, many might agree that "want" advertisements are superior to "solution" advertisements in the case of readers who are not interested, while maintaining that once a reader is familiar with the product a "solution" advertisement is superior because it emphasizes the trade-name to a greater extent. It is a question, however, whether repetition of the name, and space devoted to a description of the article, contribute more to impressing the name on a reader's memory than does copy that arouses desire.

It is generally recognized, of course, that when prospective

buyers are not familiar with the advertised commodity it is necessary to "educate" them. In doing so their wants are usually emphasized. But when they are familiar with the commodity the usual practice is to emphasize the trade-name, considerably at the expense of the want. Most authorities would probably agree that our "want" advertisements would be more efficient in educating prospects than our "solution" advertisements. But judging from the advertising that appears in current publications, most authorities would claim that our "solution" advertisements would be more effective in selling a specific trade-named commodity in contrast with competing trade-named commodities. This experiment is designed to throw light on this last point.

Consequently, these two types of advertisements are not here measured in terms of the desire they arouse for the goods but merely in terms of the extent to which the *trade-name is impressed on the mind of the reader.* If then a "want" advertisement (such as 10-W reproduced below), which devotes only one paragraph to the commodity and mentions the trade-name but *three* times, impresses that name upon the reader to a greater extent than does a "solution" advertisement (such as 10-S) which gives half of its space to the commodity and mentions the trade-name *five* times, we must conclude that "want" advertisements are superior to "solution" advertisements not only in the case of educating people to buy, but also in the case of *reminding them to buy a specific trade-named commodity.*

Below there are reproduced five pairs of advertisements illustrating the two types—"want" and "solution"—on which this investigation is based. The first three pairs are examples of "want" advertisements that were markedly superior to corresponding "solution" advertisements. The last two pairs are examples of the reverse. In each case, the experimental efficiency and margin of superiority is indicated (percentages taken from table 2).

Advertisement 10-W. 14 per cent superior to 10-S; experimental efficiency 49 per cent

The big party she missed

For months she had been looking forward to this affair—probably the most gala event of the winter season.

And more than that—the man who was to take her was looked upon as the one real "catch" in her set.

A week before the big night she felt a dry, rasping hitch in her throat. She neglected it and kept right on going.

A few days later her throat was so inflamed she could hardly swallow food. And then a rapidly rising temperature.

The doctor ordered her to bed—and kept her there three days. On the evening she wanted most to feel fit, she was confined to the house like a little old lady—and the others were dancing.

Don't let sore throat throw you out of step with the pleasures you've planned.

Guard against this trouble by taking the simple precaution of using Dixol, the safe antiseptic. Have Dixol handy always in your bathroom. It is a valuable preventative for throat irritations and the more serious ills that so often follow.

DIXOL

Advertisement 10-S. Experimental efficiency 35 per cent.

FOR SORE THROAT
A Safe Antiseptic

Extra strains mean a lowering of bodily resistance and demand a precaution against infections.

Sore throat is a result of infection in the mucous membranes in the throat. The only way to prevent it is to ward against the germs that cause it; and the best way is by gargling the throat with an efficient antiseptic.

Dixol is not only an efficient antiseptic but is thoroughly pleasant to use, and safe at all times. It is the result of intensive scientific study of the infectious sources of sore throat. Dixol is specially prepared to specifically combat bacterial onsets upon the delicate, sensitive membranes that line the throat.

Even a slight sore throat is an annoying inconvenience. And a bad one means a fever and confinement to bed. Guard against any such attack by always keeping a bottle of Dixol handy on the bathroom shelf. And don't wait for a dry rasping hitch in the throat—gargle regularly with warm water and Dixol.

DIXOL

Advertisement 1-W. 15 per cent to 1–S; experimental efficiency 86 per cent

From the diary of any Danton owner

I have found a car that is a true companion.

It never whimpers, never grumbles. What I want it to do it does—willingly, efficiently.

Wherever I want to go, it takes me—through heavy traffic without straining my nerves or my patience. It leaves the paved roads for rough roads without a murmur. Even seems to smile in the joy of going where few will follow. Seems to resent the rear end of a car ahead.

It holds the road and follows its course with something akin to instinct—like a horse that knows its way and needs but gentle guidance.

The contentment I feel behind its wheel makes my motoring a soothing pleasure. Its ready power and effortless performance let me relax when I drive. To sit and ride for hours is like being snugly settled at home in my big easy-chair, with the world flying by.

My Danton is healthy and vigorous, like a spirited animal in pink of condition. It is quite unfamiliar with repair shops, for it needs but little attention to keep it always in perfect trim. With a soft cloth I can renew its sleek appearance after any ordinary run. From my seat, in scarce half a second, I can at any time lubricate all moving body parts. No wonder there's never a whine from its stalwart frame.

Above all, I can always TRUST it.

Who wouldn't call such a car a Companion!

DANTON MOTOR CARS

Advertisement 1–S. Experimental efficiency 71 per cent

Economical, Care-Free Service
Far Above Its Price-Class

It is not too much to say that the Danton is one of the most skilfully engineered cars in America.

It is likewise true that in many processes of its production important economies, with better and finer results, have been achieved.

Translated into concrete terms, this means a car selling for considerably less than $1,000, that accelerates from 5 to 25 miles an hour in eight seconds; that delivers its reliable mileage at maintenance and operating costs so low as literally to amaze.

How Danton engineering saves the owner money is illustrated by a score or more of structural details.

In ordinary construction, the power impulses, however smooth the motor may be, are transmitted to the chassis, while shock and vibration due to road roughness are likewise transmitted to the motor. The front end of the Danton motor is mounted upon a floating platform

spring, which actually increases motor smoothness and protects the motor from road shock.

So throughout the entire car—at every turn, advanced engineering and precision manufacturing save for the owner.

Thus, in the Danton the buyer gets a car that provides economy in the price, and even more important economy in the low cost for which it returns its reliable, care-free service.

DANTON MOTOR CARS

Advertisement 14-W. 13 per cent superior to 14-S; experimental efficiency 41 per cent

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Don't Take Your Shower in the Garden!

How often have you wished you had worn rubber boots and a raincoat when watering the lawn or garden? How often have wet shoes and clothing marked the end of what should have been an enjoyable task?

The user of Good Luck Garden Hose never experiences these annoyances. From the time he starts unrolling it to the time it is put away again, he finds his task an easy, even pleasurable, one. Good Luck hose is "built to stay alive" and give long unfailing service. It rolls and unrolls easily, lies flat and never kinks. It thus prevents the annoyance caused by "stubborn" hose; and since it will not kink it does away with the many leaks that waste water and sprinkle the user instead of what should be sprinkled.

You can keep dry and cheerful if you use Good Luck Garden Hose.

GOOD LUCK GARDEN HOSE

Advertisement 14-S. Experimental efficiency 28 per cent

Six Protecting Plies

Consider how Good Luck hose is made! Around the live rubber tube are six tightly wrapped layers or plies of stout cotton fabric filled with rubber gum and encased in a tough cover. Tube, plies and cover are all vulcanized together into a solid yet flexible wall. The result is a light, strong garden hose which gives years of service around house or garden. Good Luck Hose is "built to stay alive", because it is built of live materials combined with long manufacturing experience.

Good Luck Garden Hose has a $\frac{3}{4}$" water channel, because this is the logical size for hose to be used with house or lawn sill cocks. Sizes smaller than $\frac{3}{4}$" will not deliver all the water from $\frac{1}{2}$" hose fittings, and larger sizes will not deliver enough more than $\frac{3}{4}$" to justify their increased weight and expense.

Ask your dealer to show you Good Luck Garden Hose.

GOOD LUCK GARDEN HOSE

Advertisement 4-W. 3 per cent inferior to 4-S; experimental efficiency 50 per cent

"But, DOROTHY, salad forks go on the INSIDE!"

Dorothy changed the forks with a start. She resented Mary's tone of mingled surprise and reproval. But she resented more the fact that she *didn't* know where the salad forks went. No wonder, either. There were no salad forks at home, nor bouillon spoons, nor many of the other beautiful things they used at Mary's house. Dorothy felt as though she had missed much—because her mother hadn't enough silverware.

You should have enough silverware of beauty and correctness to make possible correct and gracious serving at every family meal. It should help your children to be so familiar with correct usage that good table manners are their natural inheritance.

But perhaps yours doesn't! Even now you may be "getting along" with silverware that falls short of your taste and desire—all because you fear the expense of purchasing the necessary pieces.

But you need not fear it. In House of Burgundy Silverplate you can complete your silver service at surprisingly little outlay. You may purchase in quantities as small as you desire the important niceties of table setting—bouillon spoons, salad forks, coffee spoons or serving pieces. Thus you may acquire, a little at a time, silverware whose beauty and durability will give you lasting satisfaction.

And when you need more pieces in the chosen pattern, you will be able to get them easily; for the leading dealers always have the newer House of Burgundy patterns in their stock.

HOUSE OF BURGUNDY SILVERWARE

Advertisement 4-S. Experimental efficiency, 53 per cent

Hidden Treasure

If the plating of a Super Plate spoon were peeled back at the two rest points, it would show clearly the exact meaning of the phrase, "Solid Silver Where It Wears". For the pieces that are in constant use—tea, dessert, soup and table spoons, breakfast and dinner forks—have hidden beneath the surface of a scientifically applied plate, little blocks of solid silver inlaid at the back of handle and back of bowl in the new Super Plate—Inlaid from the House of Burgundy.

All other pieces are scientifically plated to resist wear, making the most desirable table silver the discriminating hostess could ask for.

For nearly half a century the House of Burgundy has been manufacturing quality silver plate and has established for itself an enviable reputation for high grade merchandise of superior quality and beautiful design.

The price for this fine quality in a rare assortment of beautiful patterns is reasonable, and your jeweler will gladly quote you on whatever assortment you may be interested in.

HOUSE OF BURGUNDY SILVERWARE

Advertisement 8-W. 11 per cent inferior to 8-S; experimental efficiency, 28 per cent

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Little Harmonies
that make life more cheerful

"I want to tell you how happy Satinette has made me," writes Miss Agnes Miller of Chicago. "I have just finished enameling the furniture in my bedroom. A week ago my chiffonier was cherry, my bureau yellow maple, my chairs walnut, and my bed mahogany. Now everything is a perfect harmony of color, and my room is simply fairyland."

"Speaking of miracles," writes Mr. George Baker of Oakland, California, "I wish you could see my study-den now. Two years ago I partitioned off a room in the attic as my own quiet retreat. From time to time I added to its furnishings with old odds and ends from all over the house. Finally it looked like a storage attic of worthless cast-offs, for everything looked dingy and shabby and nothing matched. Last week I worked out a simple color scheme and started in with Satinette. Now my study-den is the cheeriest room in the whole house and my friends won't believe I worked the miracle myself."

Every man and woman will appreciate the experiences given above. It is no longer necessary to tolerate the annoyance of having furniture that doesn't "match", that's shabby and unattractive.

With Satinette Enamels it is so easy to create a harmonious and cheerful color scheme, so easy to make old pieces fresh and like new, that countless people are finding its use a simple and pleasant way to work miracles in brightening and re-juvenating their homes.

SATINETTE ENAMEL

Advertisement 8-S. Experimental efficiency, 39 per cent

The Mellow Beauty of Satinette

So clean, so clear is Satinette's white that it seems like driven snow. So easily does it wash that it seems like fine porcelain. So enduringly does it wear that Satinette woodwork goes year upon years,—without cracking, without yellowing, without losing its beautiful appearance.

There is nothing cold or harsh about it. It dries with a mellow, soft-toned finish without rubbing, and possesses colonial-like dignity that reflects warmth and refinement.

Like good china and fine linens, Satinette enameled woodwork is a possession that warrants pride and pays for itself in long service and enduring satisfaction.

China-like is the only word that describes the lustrous beauty of the Satinette finish.

SATINETTE ENAMEL

PROCEDURE

Twenty commodities were selected and two advertisements were prepared for each, one stressing the want element and the other the solution or commodity. In nearly all cases these were direct adaptations from advertisements in actual use. In other words, twenty pairs of companion advertisements were prepared—forty advertisements in all, each "want" advertisement having its corresponding "solution" advertisement. These advertisements were then split into two groups, so that Set A contained ten "want" and ten "solution" advertisements while Set B contained the *corresponding* ten "solution" and ten "want" advertisements. Thus each group had the full twenty commodities represented by an advertisement, while each group furnished a check against the other. In testing, the subjects were likewise divided into two groups, one for each set of advertisements. The general instructions in all cases were to look over the advertisements as the subjects saw fit, to read any they wished to read and to skip any that were uninviting. To put emphasis upon reading only what was of interest, a time limit of ten minutes was announced in three of the four experiments, with the explanation that the interval was too short for one to read all the advertisements in the set. And to insure against anyone remembering *all* the advertisements, ten merely extraneous advertisements were included in two of the four experiments.

The three tests

After the subject had finished, or when the time limit was up, the following tests were employed.

Test 1 was a recall test, the instructions being to write down on a sheet of paper all the trade-names that could be recalled.

Test 2 was a controlled association test. The twenty commodities were announced one by one and the subject was requested to write down the appropriate trade-name as each was called.

Test 3 was a recognition test. Twenty *new* trade-names were mixed in with the twenty used in the advertisements. If the subject recognized the name when announced or exhibited visually he recorded a "+," otherwise a "−." Two methods of scoring the recognition test data were employed. In the first case the per cents of correct recognitions were alone considered. In the second case the per cents of incorrect recognitions were subtracted from the per cents that were correct. The former probably measures the total impression made; the latter the extent to which the correct name is definitely fixed in mind.[2]

The four experiments

Because of differences in the subjects tested, and of some variation in the experimental procedure, four experiments may be denoted which are tabulated on page 356.

In any experiment it is necessary to eliminate the effect of extraneous factors so that the final figures will measure only the single factor under consideration. This was made possible by the experimental procedure outlined above. Individuals, for example, differ markedly in their ability to observe and remember. The effect of this extraneous factor is eliminated here in that each individual is tested with respect to an equal number of both kinds of advertisements, and consequently his superior or inferior memory affects equally both sides of the equation. The effect of differences in intrinsic interest in commodities was eliminated in that there was a "want" and a "solution" advertisement for each commodity, and so these differences also affect both sides of the equation. Again, it is recognized that the first and last advertisements in a series are

[2] These three tests would seem to measure the extent to which the *tradenames* were noticed and remembered. To get some idea of which *advertisements* are most thoroughly read and remembered, further studies are planned. In these, individuals will be tested on the subject matter of the advertisements; also on their ability to recognize the last paragraph of each advertisement.

better remembered than those in the middle of the series. The effect of this factor was eliminated in that each pair of individuals was supplied with a set of advertisements arranged in a different order. For example, the order given in table 1, below, is merely the order that obtained in the case of one pair of individuals.

EXPERIMENT NUMBER	SUBJECTS	ADS USED	RECALL	ASSOCIATION	RECOGNITION	TIME LIMIT
I	30 men and women not college students	No extras	√	√	Visual* presentation*	None
II	60 men and women from two classes in advertising	No extras	√	√	Visual	10 minutes
III	56 men and women from a class in elementary psychology	10 additional ads used	√	√	Auditory	10 minutes
IV	114 men and women from a class in elementary psychology	10 additional ads used	Omitted†	Given first in this case	Auditory	10 minutes

* The visual method was possibly a fairer test inasmuch as it more nearly approximated the original presentation of the tradename, it being a visual stimulus in the advertisements.

† This recall test was omitted in experiment IV since it was thought at the time that the results of this test might influence the response to the other two tests. There is no evidence, apparently, that it did.

New trade-names were substituted for names in actual use. And to obtain a fair assortment of names that were neither too easy nor too difficult to remember considerable experimentation was first carried out.

TABLE 1

Showing the ezperimental procedure

Half of the 56 individuals tested, handled Set A; the other half, Set B. The data show the percentage of individuals that recalled the trade-name.

TRADE NAMES	SET A			SET B		
	"Want" ads	"Solution" ads	Additional ads	"Want" ads	"Solution" ads	Additional ads
Danton Automobile	70	—	—	—	45	—
P & H Hoist	—	—	16	—	—	16
Empress of Cumberland Mediterranean Cruise	—	36	—	33	—	—
Dixol Antiseptic	—	21	—	34	—	—
Mecco Steel Chair	—	—	0	—	—	3
Thoro-bred Dog Biscuit	50	—	—	—	18	—
Durex Battery	24	—	—	—	18	—
Hallet & David Player Piano	—	—	3	—	—	7
Fireside Tomato Soup	—	26	—	17	—	—
Kool Kraft Suit	—	33	—	22	—	—
Perfection Motor Car Heater	—	—	18	—	—	24
Tru-flex Bedspring	19	—	—	—	12	—
House of Burgundy Silverware	4	—	—	—	5	—
Arch Preserver Shoe	—	—	18	—	—	5
Comfo Davenport Bed	—	5	—	21	—	—
Lista Blanca Toothpaste	—	29	—	28	—	—
Congoleum Rug	—	—	54	—	—	53
Mercury Auto Safety Light	13	—	—	—	11	—
Dixie Range	28	—	—	—	8	—
American Boy	—	—	50	—	—	45
Rayite Auto Enamel	—	23	—	17	—	—
Good Luck Garden Hose	—	8	—	36	—	—
Stewart Brons Bearing Metal	—	—	6	—	—	8
Logan Lawn Mower	15	—	—	—	26	—
Satinette Enamel	4	—	—	—	24	—
Thermotite Construction	—	—	25	—	—	26
Vapite Firefoam	—	16	—	17	—	—
Mytho Hair Color Restorer	—	8	—	12	—	—
Oakite Cleaning Material	—	—	8	—	—	0
Glowtone Shades	16	—	—	—	9	—
Averages	24.3	20.5	19.8	23.7	17.6	18.7
				24.3	20.5	19.8
Averages of Sets A and B				24.0	19.05	19.25
Ratios				126	100	101

TABLE 2

Showing the per cent of individuals who remembered the trade names of "want" and "solution" advertisements as measured by Recall, Association and Recognition Tests in experiments III and IV

(170 individuals tested)

	"WANT" ADS					"SOLUTION" ADS					DIFFERENCE (COLS. 5 AND 10)
	Recall	Association	Recognition (1)	Recognition (2)	Average	Recall	Association	Recognition (1)	Recognition (2)	Average	
Danton Automobile	70	81	96	96	86	45	59	91	90	71	15
Lista-Blanca Tooth paste	28	45	91	88	63	29	46	87	87	62	1
Fireside Tomato Soup	17	58	88	82	61	26	60	81	78	61	0
House of Burgundy Silverware	4	39	79	78	50	5	36	86	84	53	−3
Mercury Auto Safety Light	13	35	81	70	50	11	29	79	73	48	2
Comfo Davenport Bed	21	31	76	61	47	5	24	63	44	34	13
Vapite Firefoam	17	24	77	66	46	16	13	78	61	42	4
Satinette Enamel	4	18	55	36	28	24	32	63	37	39	−11
Tru-Flex Bed Springs	19	27	69	59	44	12	17	68	57	39	5
Dixol Antiseptic	34	38	64	58	49	21	11	53	40	35	14
Glow-tone Window shades	16	17	69	59	40	9	12	54	42	29	11
Dixie Ranges	28	21	66	59	44	8	27	76	61	43	1
Empress of Cumberland Mediterranean Cruise	33	56	96	96	73	36	54	88	86	66	7

Good Luck Garden Hose	36	29	62	38	41	8	17	53	32	28	13
Rayite Auto Enamel	17	17	65	25	31	23	12	58	24	29	2
Thorobred Dog Biscuit	50	43	91	87	68	18	54	86	85	61	7
Logan Lawn Mower	15	11	71	61	40	26	21	69	52	42	−2
Mytho Hair Color Restorer	12	24	77	68	45	8	13	77	58	39	6
Durex Battery	24	23	82	80	52	18	22	78	74	48	4
Kool Kraft Suit	22	41	92	92	62	33	33	92	91	62	0
Averages	24.0	33.7	77.4	68.0	51.0	19.1	30.4	74.0	62.8	46.6	4.4
Ratios	126	111	105	108	109	100	100	100	100	100	9

For the purpose of making the experimental procedure clear, the data secured in the Recall Test in experiment III is given below in table 1. In this experiment ten additional advertisements, the very same in both cases, were included in both Set A and Set B.[3] The figures in the table represent the percentage of individuals who recalled the trade-names. Thus, 70 per cent of the individuals who handled Set A recalled "Danton" after having seen the Danton "want" advertisement, whereas only 45 per cent of the individuals who handled Set B recalled that trade-name after having seen the companion Danton "solution" advertisement. The average percentage for the ten "want" advertisements in Set A was 24.3 per cent, in Set B, 23.7 per cent, a final average of 24.0 per cent. The average for the ten "solution" advertisements in Set A was 20.5 per cent, in Set B, 17.6 per cent, a final average of 19.05 per cent. This gives 26 per cent greater efficiency for the "want" advertisements.

RESULTS

"Want" advertisements are superior to "solution" advertisements

Table 2, presenting the data from experiments III and IV, shows the per cent of individuals who remembered the trade-names from "want" as compared with "solution" advertisements. The first five columns of data refer to the twenty "want" advertisements. The second five columns to the corresponding "solution" advertisements. Column 11 gives the differences between the two types of advertisements. Thus the trade-name in the "want" advertisement of Danton automobile is remembered by 86 per cent of 84 subjects, the trade-name in the "solution" advertisement by 71 per cent of 86 subjects, a difference of 15 per cent in favor of the "want" advertisement.

[3] No significance should be attached to the data from the ten additional advertisements. They were selected at random and inserted merely for the purpose of enforcing a "weeding out" process in the case of the twenty other advertisements.

Columns 1 and 6 present the data from the Recall Test. This test was not used in experiment IV, so that the data are based on 56 individuals, not 170. Columns 2 and 7 present the data from the Controlled Association Test. Columns 3 and 8 give the results of the Recognition Test when only correct recognitions are considered; columns 4 and 9 when incorrect are subtracted from correct recognitions.

If the efficiency of the "solution" advertisements is expressed as 100 the "want" advertisements are 26 per cent superior, as based on the recall test; 11 per cent as based on the association test; 5 per cent as based on the recognition test (correct recognitions alone considered); and 8 per cent superior, as based on the recognition test where correct and incorrect recognitions are both considered. A final summary gives 9 per cent superiority of the "want" advertisements.

It is quite possible that others may not agree with us as to the classification of these forty advertisements. It may be that some of these advertisements are not good examples of "want" or "solution" advertisements, or so poorly worded as not to be interesting. It is even more likely that some of the wants that are appealed to in the "want" advertisements are common to older people but not particularly potent among college students. This may be the explanation as to why the "want" Satinette Enamel advertisement (8-W) was remembered by fewer persons than the "solution" advertisement (8-S).

Table 3 presents summaries of the four tests in experiments I to IV expressed in the form of ratios. (Table 2 presents the data from experiments III and IV combined.) Thus in the case of the Recall Test the "want" advertisements were found to be 8 per cent superior to the "solution" advertisements in experiment I, 10 per cent superior in experiment II and 26 per cent superior in experiment III. The average is 16 per cent when the three percentages are weighted according to the number of subjects in each experiment.

The summary of all tests in the four experiments gives a ratio of 111 to 100 in favor of the "want" advertisements.

Experiment I was a preliminary try-out. After experiment

TABLE 3

Showing the superiority of "want" advertisements to "solution" advertisements expressed in the form of ratios

The results of the three tests in the four experiments are presented; also a general summary.*

	EXPERIMENT I—30 SUBJECTS	EXPERIMENT II—61 SUBJECTS	EXPERIMENT III—56 SUBJECTS	EXPERIMENT IV—114 SUBJECTS	SUMMARY—261 SUBJECTS
1. Recall	108–100	110–100	126–100		116–100
2. Controlled Association	157–100	106–100	106–100	113–100	115–100
3a. Recognition: correct only	98–100	103–100	102–100	106–100	104–100
3b. Recognition: correct-incorrect		115–100	101–100	111–100	110–100
Final summary					111–100

* The A.D. of the difference of 6 per cent in the Controlled Association Test, Experiment III is 7.0. The 6 per cent difference is accordingly 0.86 times its A.D. The A.D. of the difference of 13.2 per cent in the Association Test, Experiment IV is 5.6. The 13.2 per cent is accordingly 2.4 times its A.D. The A.D. of the difference of 10.8 per cent in the Association test, Experiments III and IV combined (see table 2) is 4.6. The 10.8 is accordingly 2.3 times its A.D. On this basis the final difference of 11 per cent summarizing 14 tests must be judged a significant difference.

The amount of the average deviations of the averages is affected primarily by the number of subjects and whether the advertisements are all very well or poorly remembered on the one hand or remembered about half of the time on the other hand. (The A.D. of the Average would be much smaller if the advertisements were remembered by 90 per cent or 10 per cent of the subjects than if by 50 per cent of the subjects.) As advertisements were selected so as to include the whole range from well to poorly remembered the A.D. has been in a sense deliberately made large. The ratio of the difference to the A.D. of the difference, in addition to the above factors, is dependent upon the difference between "want" and "solution" advertisements. Here again the deliberate intention of the experimentors was not to use advertisements in which these elements were clearly distinguished but rather advertisements in which these elements were present, one being emphasized more than the other. It seems therefore that the consistency with which "want" advertisements are found superior to "solution" advertisements is a more reliable index of the significance of the final difference of 11 per cent than that to be obtained by statistical expressions of variability.

II was performed several of the advertisements were materially revised and fully half of the remainder were revised slightly. It is believed that the data in table 2 are accordingly more reliable than those of table 3, but for comparison both are presented. Whether "want" advertisements are 9 or 11 per cent superior to "solution" advertisements is immaterial. The significant point is that they are about 10 per cent superior when measured in terms of the memorability of the trade-name.

Any change in advertising is decidedly worthwhile that will increase the number of those who remember an advertised trade-name. This is particularly true if the more efficient advertising not only increases the memorability of the trade-name but at the same time is primarily designed to arouse a desire for the goods.

Advertisements are noticed and remembered to the extent that they appeal to existing interests

A measure of the extent to which each of the twenty *commodities* was noticed and remembered is given in column 1 of table 4. The percentages in this column are averages of columns 5 and 10 of table 2, i.e., the averages of the pairs of "want" and "solution" advertisements. Thus 79 per cent remember "Danton Automobile" while only 30 per cent remember "Rayite Auto Enamel."

Why is an auto trade-name remembered by more than twice as many persons as an auto enamel trade-name? The writers contend that this is the case, other things being equal, because an auto is of far more interest to young people than is an auto enamel. Our whole thesis is that people buy what they want, or have been made to want, they pay attention to and remember what they are interested in, and without interest and desire there is minimal attention or memory.

Experiment V was devised to throw some light on this point. Ninety-four college men and women were asked to arrange the twenty commodities (no trade-names were supplied) in order of merit according as they would buy them, on the supposition that they had more than enough cash to buy all of the twenty.

The order of merit from this experiment is given in column 3 of table 4. In column 2 is given the order of merit of the data

TABLE 4

*Showing the extent to which the memory of trade-names is influenced by desire for the commodity**

	AVERAGE OF COLUMNS 5 AND 10, TABLE 2	ORDER OF MERIT, COLUMN I	ORDER OF MERIT OF DATA FROM EXPERIMENT V	ORDER OF MERIT, COLUMN 2, WHEN ITEM NO. 3 IS OMITTED	ORDER OF MERIT, COLUMN 3, WHEN ITEM NO. 3 IS OMITTED
Danton Automobile	79	1	1	1	1
Empress of Cumberland Mediterranean Cruise	70	2	2	2	2
Thoro-bred Dog Biscuit	65	3	18		
Lista-Blanca Tooth Paste	63	4	4	3	4
Kool-Kraft Suit	62	5	3	4	3
Fireside Tomato Soup	61	6	11	5	11
House of Burgundy Silverware	52	7	5	6	5
Durex Battery	50	8	10	7	10
Mercury Auto Safety Light	49	9	7	8	7
Vapite Firefoam	44	10½	8	9½	8
Dixie Range	44	10½	9	9½	9
Mytho Hair Color Restorer	42	12½	19	11½	18
Dixol Antiseptic	42	12½	16	11½	16
Comfo Davenport Bed	41	14½	6	13½	6
Logan Lawn Mower	41	14½	15	13½	15
Glow-tone Window Shades	35	16½	14	15½	14
Good Luck Garden Hose	35	16½	12	15½	12
Satinette Enamel	34	18	17	17	17
Rayite Auto Enamel	30	19	13	18	13

* The item Tru-flex Bed Spring is omitted from this table because by error hosiery was substituted in Experiment V.

in column 1. The correlation between columns 2 and 3 is 0.61.

Only in the case of no. 16, Thoro-bred Dog Biscuit, is there any striking disagreement in the two orders of merit. This

exception really proves the rule. In experiment V the subjects were given only the two words "dog-biscuit." Most naturally they would rate it very low. If the item had been "food for your dog," the rating would undoubtedly have been different. When the advertisements were before the subjects, the idea "dog" was more prominent in their minds than that of "dog-biscuit." The subjects responded to the advertisement in terms of their interest in dogs. If this item is disregarded the two orders of merit are obtained that appear in columns 4 and 5. The correlation in this case is 0.79.

Other things being equal, a person notices, reads and remembers those advertisements which deal with his desires. If he does not want a commodity he usually does not see the advertisement at all. It is useless to attempt to arouse interest; one must start with an already existing interest and build on it.

Actually a packing concern sells "dead cow." There is no interest in that and if so advertised there would be no sale. "Canned meat" is of more interest and most advertising has been on this basis. But women today are still more interested in "leisure time," time to play bridge, go to the movies, play with their children, etc. One advertiser is now selling "dead cow" by emphasizing "leisure time." Here is an example of the proper utilization of existing interests. By causing a woman to realize that time consumed in cooking meat could be saved by buying canned meat, a greater interest is attached to the canned meat than can be stimulated by any discussion of the qualities of the meat itself.

SUMMARY

1. It is maintained that there are two major objectives in advertising: first, to make a reader want, and second, to give a solution to show how his desire may be adequately satisfied by means of the advertiser's commodity.

Nearly all those writing on advertising copy have distinguished two general types of advertisements, or at least two general types of copy. These have been described in a variety

of ways, such as: human-interest vs. reason-why, short-circuit vs. long-circuit, suggestion vs. argumentation copy. It is maintained that these classifications are inadequate. The two major objectives are: to arouse a want and to present a solution.

2. The basis of interest and the chief factor in memory is desire. It has been shown that the order in which trade-names are remembered is substantially the same order in which people are desirous of buying the commodity. One's interests cause one to read the advertisements that appeal to these interests and to remember the solutions to these desires, namely the trade-names.

3. Of the factors that strengthen a bond in learning the so-called factor of "effect" has not yet received its proper recognition, as contrasted with the emphasis given to "repetition," "intensity" and the like.

In this experiment the "want" advertisements contained fewer repetitions of the trade-name and less space devoted to describing the trade-name than the "solution" advertisements yet the "want" advertisements produced greater memorability of the trade-name.

4. The most efficient advertisements, other things being equal, are those that arouse a want for the commodity, even when the efficiency is measured not in terms of desire to buy, but in terms of the memorability of the trade-name.

This conclusion should not, however, be carried to an extreme. Not only must prospective buyers be made to want but they also must be convinced that the advertised commodity will be an adequate solution to their wants. Arousal of wants and satisfaction of those wants are the first and third steps in the whole process. But the intermediate step of convincing the prospect that the advertised solution will satisfy his wants must be present also.

PHENOMENAL MEMORIZING AS A "SPECIAL ABILITY"

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Theories of behavioral constitution have sometimes assumed the existence of special capacities in complex traits: peaks of talent rising conspicuously above an individual's general ability level. This doctrine finds a common expression in the belief that the feeble-minded tend to show a high development of "memory"—a widespread popular view, which has considerable support in psychological literature. Restated in terms of the distribution curve, the theory implies that individuals in the lowest percentiles in general ability may be found in the highest percentiles in the ability to memorize and retain simple material. We have, for example, the following statement by William James (1): "Imbeciles sometimes have extraordinary desultory memory . . . . the mere organic retentiveness of a man need bear no definite relation to his other mental powers."

Tredgold (2) observes: "In a considerable proportion of idiot-savants the gift is one of memory in some form or other, and of this many interesting and remarkable examples have been cited."

See also Forbes Winslow (3): "Idiots have exhibited the faculty of retention to a remarkable extent, and men of very limited and circumscribed powers of reasoning and of most defective judgment have had memories distinguished for their tenacity."

Similar references are frequently found, to "imbeciles with unusually tenacious memories," Ireland (4); to "remarkable memory for places exhibited in certain idiots of low mental capacity," Griesinger (5); or to "idiots found to possess a special faculty of storing in their brains . . . . masses of figures like railway time tables and budget statistics," Lancet (6).

Making allowance for the non-specific use of the terms idiot and imbecile, it is nevertheless apparent that many writers during the past few decades have agreed with Winslow in the opinion that "great vigor of memory is often conjoined with a low order of intelligence."

If we turned to the actual case records, we find very little beyond a repetition of the claims already stated, reinforced by anecdotes that are entertaining but not always persuasive. Tredgold cites the case of a patient in the Earlswood Asylum, who made a specialty of biographical history. "It is only necessary to mention to him the name of any prominent personage, in early or ancient history, and out there flows in a steady unhesitating stream a full account of his birth, life and death. His knowledge has been acquired by poring over biographical details in such books as were available. . . . ."

Barr (9) in connection with the problem of echolalia, gives the following report of an inmate of his institution:

> K. M. M., idio-imbecile, white, male, epileptic, aged twenty-two years. Healthy up to the age of sixteen months. He began to talk with the ease of a normal child, but early developed a habit of peculiar repetition. . . . . His precocious memory just at this period, coupled with these abnormal repetitions, first attracted the attention of those about him as evidencing something wrong. . . . . His memory is indeed phenomenal. He recalls not only the visits of his parents and other incidents occurring during the year, but also the names of boys and attendants he has neither seen nor heard of for years, and he will sit talking to himself of them. . . . . He catches readily both words and music of all the popular songs at first hearing, repeating the words almost verbatim.

Barr appeared to consider that he was dealing with a case of extraordinary capacity for both immediate and delayed memory. It is not clear, however, that the patient's echolalia involved an unusual degree of memory span; his memory for past events, to the extent that it was exceptional, could very likely be explained in terms of exceptional repetition and exercise. Institutional reports by physicians are often vaguely descriptive; "phenomenal" may mean phenomenal for the whole population, or merely phenomenal for the sampling of feeble-minded.

A characteristic case is reported in Lancet (6) for June 5, 1909.

> At a recent meeting of the Society for Psychiatry and Neurology, Dr. Witzmann showed a man aged twenty years, who possessed an extraordinary memory for certain of the data recorded in calendars. This individual, who was, moreover, an inmate of an asylum for the feeble-minded, could with the utmost readiness tell what day of the week it had been or would be on any given day of the month from the year 1000 to the year 2000. Although he has devoted much attention to the case, Dr. Witzmann has not yet succeeded in finding out by what means the young man has acquired this faculty.

It is safe to say that he acquired the "faculty" by normal processes of learning, and it may well be that in this as in the preceding cases the performance is due not to *skill* nor special *capacity* in memorizing, but to *patience* in memorizing, aided perhaps by mnemonic devices which any school child could use.

Dr. Witzmann's subject is similar to one reported by Byrd (8), a feeble-minded negro who could name the day of the week on which any day would fall from 1900 to 1924; he had a special interest in railroads, which led him to memorize locomotive engine numbers and the names of stations on railway routes. In the Stanford Revision his basic was 4 years, with an M.A. of between 8 and 9. His auditory digit span was 5. Asked to explain his memory for dates, he declared that this information came to him in a mysterious way (!), he did not know exactly how. From a notebook which he carried with him, however, it was obvious that he had acquired his information by a process of tedious memorizing. No explanation was advanced for the origin of his interest in these matters.

During the past twenty years the work of numerous investigators has shown a positive correlation between intelligence and the scores obtained on memory tests. Burt, Brown, Simpson, Wyatt, Gates, Starch, Jones, Lee and others report coefficients ranging from 0.30 to 0.90, with a central tendency of about 0.50. (This is based on 27 correlations, and is almost certainly too low, owing to errors of measurement in the earlier studies, some

of which employed an unsatisfactory technique for determining intelligence, and some of which used too short a series of memory tests.) With a correlation of 0.50 or higher, the chances are extremely small that an individual falling 3 P.E. or more below the mean in intelligence will fall 3 P.E. or more above the mean in memorizing ability: a condition called for in the theory of the memory idiot-savant. The reputed frequency of these idiot-savants (Tredgold) may be an incorrect estimate through (*a*) inaccurate diagnosis of feeble-mindedness, (*b*) gross exaggeration of memorizing ability, due to failure to make objective tests of memory and retention or (*c*) confusion of ability factors with factors of interest and drive.

THE CASE OF K.

The writer sought to avoid these errors in studying the case of K., a phenomenal memorizer with a wide "professional" reputation. K. claimed to have a ready command of the following assortments of facts:

1. The population, by the 1920 census, of every town and city in the United States over 5000. (He had previously learned the population of all towns over 2000, by the 1910 census, but this obsolete information he was now "trying to forget.")
2. The names, the number of rooms, and the location of about 2000 leading hotels in the United States.
3. The county seats of all counties in the United States.
4. The populations of 1800 leading foreign cities.
5. The distances of all cities in this country from New York and from Chicago, and also the distance from each city or town to the largest city in its state.
6. Statistics concerning 3000 mountains and rivers.
7. The dates and essential facts connected with over 2000 leading inventions and discoveries.

In addition, he professed to have acquired a vast stock of "unclassified" facts from geography and history.

Tests in all of these fields showed that his claims were substantially correct. In giving the population of a random sampling of 50 cities from 5000 to 200,000 inhabitants, he recited 250 figures. Only 14 digits were incorrect or in the wrong

order, his accuracy score being 95 per cent. In the case of the larger cities errors were rarely made; the median reaction time was 1.4 seconds, nearly as fast as his time in free association. For cities and towns under 20,000 population, the median reaction time was 2.9 seconds, with an obviously much reduced automaticity of response.

It was found moreover that K. had learned his associations both ways (deliberately, of course, and not incidentally). The following is a sample record made in a test before a class:

Q. 74,684
A. San Diego, Cal.

Q. 83,252
A. Savannah, Ga.

Q. 8,481
A. Conshocton, Pa.

Q. 25,739
A. Saskatchewan, Can.

Q. 176,467
A. Lima, Peru.

There were no errors, and the reaction times ranged from 0.8 to 3.2 seconds. Backward associations were found in all of the classifications of facts that he had acquired. An hour's examination could sample not more than from 2 to 4 per cent of the total array of statistical information that he had available for direct recall. The striking thing in this record is not the gross number of known facts (doubtless equalled or surpassed by the average well-informed person) but the nature of the facts and the manner in which they are organized. The items in K.'s equipment are of so discrete and "bookish" a character that they possess a minimum of transfer value. In learning them, and in later rehearsal, it is necessary to give specific drill to each item; one would suppose that very little logical assembling is possible. In the course of years, however, K. has acquired so many associations with combinations of

digits, that it is difficult to give him a number which he cannot analyze into a familiar sequence. Thus he is able to learn numbers in terms of suggested and symbolized earlier memories. When given the number 4836179621 he studied it for 35 seconds, and gave a recall without error after a 4-hour interval. He describes his method as follows:

> When I saw this number I read it as 4,836,179,621. I remembered 4 because of the 4th of July. 836 I just had to memorize, without any help, but if I were doing it again it would probably occur to me that 836 was the Chinese population of the state of Texas in 1910, and then I couldn't forget it. 179 is easy to remember because that is the number of miles from New York to Harrisburg, and 621 is the number of a house I know of in Denver, Colorado.

By these linkages he was able to reduce the number from 10 to 4 units; I found that he was equally facile in attaching meanings to other number sequences. In some instances, if no associations were available, he would modify the number slightly and remember the modification. Thus, 30249385274 was divided into 30,249,385,274 and promptly assigned the following associations:

> 30 is the number of days in a month. 249—if that were 149 it would be the distance from Chicago to Peoria, Illinois. 385—I once paid $3.85 railroad fare going from Cheyenne, Wyoming to Wheatlands, Wyoming. 274—I can remember that by putting a 6 in front of it for the time being; 6274 is the seating capacity of the Hippodrome.

Such complications must tend to increase interference effects, which in any case would be expected to be large, due to the frequent similarity and overlapping of number series.

> I can memorize things best when I see them on paper, and best of all when I write them down. Anything new I usually like to write three or four times so as to be sure not to forget it. About once a year I try to brush up everything I know, and go over all the facts in my notebooks.

It would require nearly a week of full working days to give each connection a single recall. In his daily occupation as a sideshow performer, a certain proportion of his facts are greatly overlearned. Others, however, may perhaps never be exercised

on the demonstration platform, and must be subject to a systematic rehearsal if they are to be retained.

K. was given four interviews of from two to three hours each, with measurements of specific memory abilities, a test of general intelligence, and a detailed inquiry into the early history of his obsession for facts.

Intelligence test results

With a chronological age of 38, K. obtained a mental age of 11 years 10 months in the Stanford Revision, with an I.Q. of 0.74 (0.79 on the 15-year hypothesis.) Coöperation was excellent. All of the tests were passed at the 9-year level, and none at year 16. His vocabulary (58 words) was superior to his other abilities, as might be expected from the fact that since 1911 he has been connected with exhibits, and has been encouraged to develop a verbose platform manner. He was unable to pass the memory for designs at 10 years, nor the digits reversed, fables, nor dissected sentences at 12 years. The following typically inadequate responses may be quoted, from the fable interpretations:

The Fox and the Crow: "In the first place, there was deception there. Both deception and selfishness, that was the motive."

The Milkmaid and her Plans: "It teaches us some lesson to profit by. She spilt the milk on the old dress. But what was she worrying about? She could get some more milk soon, and then she could buy a new dress."

He was unable to grasp verbal material except in small units; in such a test as the Problems of Fact, each sentence had to be read twice before he could comprehend the situation; his reactions to this test (14-year level) were similar to those commonly obtained from 12-year-old children. An attempt to give the Army Alpha was abandoned because of his confusion in taking directions.

Results on tests of memorizing ability

1. Digit span, auditory presentation (one per second). Six digits were repeated correctly on three successive trials. Three trials with 7 digits resulted in uniform failure. Six digits are placed by Terman at the 10-year level.

2. Paired associates, visual presentation. A test was used comprising 24 paired associates, taken from the Kent-Rosanoff frequency tables, and including equal numbers of associates of high, medium, low and "unique" frequency. In each case the S and R terms are common words of one or two syllables. The score in an immediate recall (with visual presentation of the stimulus word) was 33 per cent. In the writer's standardization of this test on college students, the median score for immediate recall is 74 per cent.

3. Logical memory, auditory presentation. The Marble Statue test (7) was given and scored by the method of retained members. K. obtained a score of 34, which corresponds to the norm for male 12-year-olds (34.7, 156 cases) and is approximately 1 P.E. below the average for adults (Pyle's norms).

It appears from this evidence that K.'s capacity for verbal learning (as measured by immediate recall for memorizing confined to a standard period) is inferior to the adult norms, and is in fact close to the level achieved in his test of general intelligence. We are not then confronted with the task of explaining a high memory ability coupled with a dull intelligence, but rather with the analysis of the *drive* which has led a person with inferior general capacities (as inferior in his special field of memorizing as in other functions) to devote his life to pseudo-intellectual activity.

Personal history

Certain facts of K.'s early history are suggestive. His social maturing was slow, and he appears to have had difficulty making ordinary adjustments in school, not only because of his retarded mentality, but also on account of a speech impediment and a markedly effeminate manner.

I didn't play with the boys when I was small. I played with the girls. The boys were too rough. I didn't like outdoor games, but mostly preferred to stay at home and look at railroad maps, and figure out places to go on the map, and the names of towns I could go to.

He developed a passion for measuring and counting.

One month I counted the number of bites of food I took, and it was 9,510 bites. I counted the number of steps doing chores around the house, and the number of steps from our door-step to the post-office four miles away. I bought a yardstick and measured how far it was to a spring in the woods, and it was 223 yards.

These exhaustive scientific inquiries were rewarded by a notice in the local newspaper. Isolated from ordinary social contacts, he lived in a fantasy world of numbers.

K. received much encouragement from his mother, who regarded herself as possessing unusual memory abilities, and liked to think of the son as following in her footsteps. It is difficult to estimate to what extent K.'s later interests were determined by a mother identification. He volunteered:

I used to like to sit in a rocking chair the way my mother did; I liked to play with dolls and dishes, and help around the house. My mother always taught me to be quiet and refined and to have nice manners, and I've always tried to be just the way she taught me.

His pious effeminacy was carried to the point of using the girls' toilet in school, a practice permitted by the teacher until he reached the age of fifteen.

K. left school when seventeen years old, being unable to pass beyond the seventh grade; in spite of his alleged prowess in memory, he was inferior in school work and, as now, generally deficient in social and practical information. His career as a "memory artist" began a few years later, when he was promised an engagement in a vaudeville circuit if he would memorize the 1910 census for towns over 2000 in population; he claims to have accomplished this feat in about three weeks, working from six to eight hours a day. Since then he has gradually added new systems of data to his professional equipment; he has compiled a handbook of 130 pages, and is now at

work on a larger compendium. Steeped in scholarship and dripping with facts, he is under a compulsion to talk shop at every opportunity. When on tour, his letters read like an abstract from the World Almanac; no statistical morsel is too slight to be mentioned.

Probably because of sensitiveness to the fact of underdevelopment, he refused to submit to a physical examination. His present appearance is fairly typically eunuchoid, undersized, with a high-pitched voice, hyper-extensible wrists, scanty beard, wide hips, and a suggestion of eunuchoid fat distribution. He was late in entering puberty, and states that he had no knowledge of the facts of sex before the age of seventeen (an item which I find entirely credible). He frequently recurs to his boyhood dependence on his mother, and to the fact that he has always suffered from the ridicule and practical jokes of male associates. An obvious inference is that his interest in memorizing has in large part served as a compensation for an inferiority reaction. His platform performances have taken on a ritual character, with a clear exhibitionistic coloring; under the influence of his advertising posters, he has begun to regard himself as a genius.

The salient features of the case are: (1) Gonadal inferiority: eunuchoid constitution; (2) intellectual and social inferiority; (3) extraordinary memorizing as a mechanism of (*a*) direct compensatory adjustment and (*b*) mother identification.

It is suggested that future reports on special proficiencies in complex traits be accompanied by objective records of the traits in question, and a developmental history. If the concepts "idiot-savant" and "genius" are worth preserving, it may be that the first will come to bear the same relation to mental defect that the second bears to mental superiority: the differences at each level being statable not in terms of general or special capacity, but in terms of an atypically focalized habit system. The weight of evidence remains in favor of Thorndike's canon (10): "In original nature, the rule is correlation, not compensation." Compensating traits, when shown to occur, should always be considered in the light of genetic analysis.

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TABLE OF STANDARD ERRORS AND PROBABLE ERRORS OF PERCENTAGES FOR VARYING NUMBERS OF CASES[1]

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This table was evolved to meet the immediate research needs of our staff at the University of Minnesota. It has already demonstrated its serviceability during the past year, having aided graduate students and instructors in carrying out three extensive pieces of research. The computational work in these researches would have been nearly prohibitive had this table not been available; hence we are certain that this labor saving table will be welcomed by workers dealing with material involving the standard errors or probable errors of percentages.

DERIVATION OF TABLE

The formula as given by Yule for the standard error of a proportion is:

$$\sigma_p = \sqrt{\frac{pq}{n}}$$

where p equals the percentage or proportion, q equals the difference between p and 1.00, and n equals the number of cases.[2] Since p always varies between 0.0 and 1.00 and q always varies between the same limits, and since the products

[1] Edgerton is responsible for the actual development of this table following out the suggestion of Paterson. Both authors are responsible for the accompanying descriptive material.

[2] G. Udney Yule: An Introduction to the Theory of Statistics, p. 257, formula (2), J. B. Lippincott, 1924.

of pq can be determined in advance for all the possible varying combinations from 0.01 and 0.99 to 0.50 and 0.50, we are able to draw up the table in such a way as to show the square roots of any of these combinations divided by varying numbers of cases. Across the top of the table (at the head of each column) are to be found all of the possible values of p. In the first column of the table are given various values of σ_p ranging from 0.100 or 10 per cent (where σ_p is a maximum for a percentage of 50 based on 25 cases) to 0.001 or 0.1 per cent (where σ_p is a minimum for a percentage of 50 based on one million cases). These σ_p values vary from 0.001 to 0.100 by successive steps of 0.001 intervals; hence there are one hundred σ_p values.

The main body of the table, showing varying numbers of cases, was built up from the various combinations of pq and the varying values of σ_p shown in the first column of the table. Twenty-five cases were arbitrarily taken as the minimum number, since proportions based on any smaller number would be of very doubtful validity. The upper limit of cases is one million, which was fixed by the requirement of showing a standard error as small as 0.001 for a percentage of 50. These various limits should meet the needs of most psychological studies involving the computation of standard errors of percentages.

To facilitate calculations involving the standard error of the difference between percentages we have included in the second column of the table the squares of the σ_p values. The conversion of these σ_p values and their squares into PE values and their squares was also computed and entered in the last two columns of each page in order that the significance of the difference between percentages could as readily be determined on the basis of probable errors as on the basis of standard errors. This conversion for PE_p was made by multiplying the various σ_p values by 0.6745 carrying the product to four decimal places. These four place products were then squared to give PE^2_p values to the eighth decimal place. The PE_p values in the table are printed only to the third decimal place and the PE^2_p values in the table are printed only to the sixth decimal place.

Edgerton's Table of Standard Errors and Probable Errors of Percentages for Varying Numbers of Cases

σ_p	σ^2_p	50%	49–51%	48–52%	47–53%	46–54%	45–55%	44–56%	43–57%	42–58%	41–59%	PE^2_p	PE_p
.100	.010000	25	25	25	25	25						.004543	.067
.099	.009801	*	*	*	*	*	25	25	25	25		.004449	.067
.098	.009604	26	26	26	26	26	26	*	*	*	25	.004369	.066
.097	.009409	*	*	*	*	*	*	26	26	26	*	.004277	.065
.096	.009126	27	27	27	27	27	27	27	*	*	26	.004186	.065
.095	.009025	*	*	*	*	*	*	*	27	27	27	.004096	.064
.094	.008836	28	28	28	28	28	28	28	28	*	*	.004020	.063
.093	.008649	29	29	29	29	29	*	*	*	28	28	.003913	.063
.092	.008464	*	*	*	*	*	29	29	29	29	*	.003844	.062
.091	.008281	30	30	30	30	30	30	30	*	*	29	.003758	.061
.090	.008100	31	31	31	31	31	*	*	30	30	30	.003684	.061
.089	.007921	*	*	*	*	*	31	31	31	31	*	.003600	.060
.088	.007744	32	32	32	32	32	32	32	32	*	31	.003516	.059
.087	.007569	33	33	33	33	33	33	*	*	32	32	.003434	.059
.086	.007396	34	34	34	34	*	*	33	33	33	33	.003364	.058
.085	.007225	35	*	*	*	34	34	34	34	34	34	.003283	.057
.084	.007056	*	35	35	35	35	35	35	35	*	*	.003204	.057
.083	.006889	36	36	36	36	36	36	36	36	35	35	.003125	.056
.082	.006724	37	37	37	37	37	37	37	*	36	36	.003058	.055
.081	.006561	38	38	38	38	38	38	38	37	37	37	.002981	.055
.080	.006400	39	39	39	39	39	39	*	38	38	38	.002905	.054
.079	.006241	40	40	40	40	40	40	39	39	39	39	.002830	.053
.078	.006084	41	41	41	41	41	41	41	40	40	40	.002767	.053
.077	.005929	42	42	42	42	42	42	42	41	41	41	.002694	.052
.076	.005776	43	43	43	43	43	43	43	42	42	42	.002621	.051
.075	.005625	45	45	44	44	44	44	44	44	43	43	.002550	.051
.074	.005476	46	46	46	46	45	45	45	45	45	44	.002490	.050
.073	.005329	47	47	47	47	47	47	46	46	46	46	.002421	.049
.072	.005184	48	48	48	48	48	48	48	47	47	47	.002352	.049
.071	.005041	50	50	50	50	49	49	49	49	49	48	.002285	.048
.070	.004900	51	51	51	51	51	51	51	50	50	50	.002228	.047
.069	.004761	53	53	53	53	52	52	52	52	51	51	.002162	.047
.068	.004624	54	54	54	54	54	54	54	53	53	53	.002098	.046
.067	.004489	56	56	56	56	56	55	55	55	55	54	.002034	.045
.066	.004356	58	58	58	58	57	57	57	57	56	56	.001980	.045
.065	.004225	60	60	59	59	59	59	59	58	58	58	.001918	.044
.064	.004096	62	61	61	61	61	61	61	60	60	59	.001858	.043
.063	.003969	64	63	63	63	63	63	63	62	62	61	.001798	.042
.062	.003844	66	66	65	65	65	65	65	64	64	63	.001747	.042
.061	.003721	68	68	68	68	67	67	67	66	66	66	.001689	.041
.060	.003600	70	70	70	70	70	69	69	69	68	68	.001632	.040
.059	.003481	73	73	72	72	72	72	71	71	71	70	.001576	.040
.058	.003364	75	75	75	75	75	74	74	74	73	73	.001529	.039
.057	.003249	78	78	78	78	77	77	77	76	76	75	.001475	.038
.056	.003136	81	81	81	80	80	80	79	79	79	78	.001421	.038
.055	.003025	84	84	84	83	83	83	82	82	82	81	.001369	.037
.054	.002916	87	87	87	87	86	86	86	85	85	84	.001325	.036
.053	.002809	90	90	90	90	90	89	89	88	88	87	.001274	.036
.052	.002704	94	94	94	93	93	93	92	92	91	91	.001225	.035
.051	.002601	98	97	97	97	97	97	96	96	95	94	.001176	.034

Edgerton's Table of Standard Errors—Continued

σ_p	σ^2_p	50%	49–51%	48–52%	47–53%	46–54%	45–55%	44–56%	43–57%	42–58%	41–59%	PE^2_p	PE_p
.050	.002500	102	101	101	101	101	101	100	100	99	98	.001136	.034
.049	.002401	106	106	106	105	105	105	104	104	103	102	.001089	.033
.048	.002304	110	110	110	110	110	109	109	108	107	107	.001043	.032
.047	.002209	115	115	115	115	114	114	113	113	112	111	.001005	.032
.046	.002116	120	120	120	120	119	119	119	118	117	116	.000961	.031
.045	.002025	126	126	126	125	125	124	124	123	123	122	.000918	.030
.044	.001936	132	132	131	131	131	130	130	129	128	127	.000876	.030
.043	.001849	138	138	138	137	137	137	136	135	134	133	.000841	.029
.042	.001764	145	145	144	144	144	143	143	142	141	140	.000801	.028
.041	.001681	153	152	152	151	151	150	150	149	148	147	.000762	.028
.040	.001600	160	160	159	159	159	158	157	157	156	155	.000724	.027
.039	.001521	168	168	168	168	167	166	166	165	164	163	.000692	.026
.038	.001444	177	177	177	177	176	175	175	174	173	172	.000655	.026
.037	.001369	187	187	187	186	186	185	184	183	182	181	.000620	.025
.036	.001296	198	198	198	197	197	196	195	194	193	191	.000586	.024
.035	.001225	210	209	209	209	208	207	207	205	204	203	.000557	.024
.034	.001156	222	222	222	221	221	220	219	218	217	215	.000524	.023
.033	.001089	236	236	236	235	235	234	233	232	230	229	.000493	.022
.032	.001024	251	251	251	251	250	249	248	247	245	243	.000462	.022
.031	.000961	268	268	268	267	267	266	264	263	261	260	.000437	.021
.030	.000900	287	287	286	286	285	284	283	281	279	277	.000408	.020
.029	.000841	307	307	307	306	305	304	303	301	299	297	.000380	.020
.028	.000784	330	330	330	329	328	327	325	324	322	319	.000353	.019
.027	.000729	355	355	355	354	353	352	350	349	346	344	.000331	.018
.026	.000961	384	384	383	383	382	380	378	376	374	372	.000306	.018
.025	.000625	416	416	415	414	413	412	410	408	405	402	.000282	.017
.024	.000576	452	452	452	451	449	448	446	443	441	438	.000259	.016
.023	.000529	493	493	493	492	490	488	486	484	481	477	.000240	.016
.022	.000484	540	540	539	538	537	535	533	530	526	523	.000219	.015
.021	.000441	594	594	593	592	591	588	586	583	579	575	.000199	.014
.020	.000400	657	657	656	655	653	650	647	644	640	636	.000180	.013
.019	.000361	730	730	729	727	725	723	719	716	711	706	.000164	.013
.018	.000324	816	816	815	813	811	808	804	800	795	789	.000146	.012
.017	.000289	918	917	916	914	912	909	905	900	894	888	.000130	.011
.016	.000256	1040	1040	1038	1036	1033	1030	1025	1020	1013	1006	.000114	.011
.015	.000225	1189	1188	1187	1184	1181	1177	1171	1165	1158	1150	.000102	.010
.014	.000196	1371	1371	1369	1366	1362	1358	1351	1344	1336	1327	.000088	.009
.013	.000169	1600	1599	1597	1594	1589	1584	1576	1568	1559	1548	.000076	.009
.012	.000144	1890	1889	1887	1883	1878	1871	1863	1853	1841	1829	.000064	.008
.011	.000121	2267	2266	2263	2259	2253	2244	2234	2223	2209	2194	.000054	.007
.010	.000100	2770	2768	2765	2760	2752	2742	2730	2715	2699	2680	.000045	.007
.009	.000081	3460	3458	3454	3447	3438	3425	3410	3392	3371	3348	.000036	.006
.008	.000064	4444	4442	4437	4428	4415	4399	4380	4357	4330	4300	.000028	.005
.007	.000049	5917	5914	5907	5895	5879	5857	5831	5801	5765	5725	.000022	.005
.006	.000036	8264	8261	8251	8234	8211	8181	8145	8102	8052	7996	.000016	.004
.005	.000025	12345	12340	12325	12301	12266	12222	12167	12103	12029	11945	.000011	.003
.004	.000016	20408	20399	20375	20334	20277	20204	20114	20008	19885	19746	.000007	.003
.003	.000009	40000	39984	39936	39856	39744	39600	39424	39216	38976	38704	.000004	.002
.002	.000004	111111	111066	110933	110711	110399	109999	109511	108933	108266	107511	.000002	.001
.001	.000001	1000000	999600	998400	996400	993600	990000	985600	980400	974400	967600	.000000	.001
σ_p	σ^2_p	50%	49–51%	48–52%	47–53%	45–54%	45–55%	44–56%	43–57%	42–58%	41–59%	PE^2_p	PE_p

Edgerton's Table of Standard Errors—Continued

σ_p	σ^2_p	40–60%	39–61%	38–62%	37–63%	36–64%	35–65%	34–66%	33–67%	32–68%	31–69%	PE^2_p	PE_p
.100	.010000											.004543	.067
.099	.009801											.004449	.067
.098	.009604	25	25									.004369	.066
.097	.009409	*	*	25	25							.004277	.065
.096	.009126	26	26	*	*	25						.004186	.065
.095	.009025	*	*	26	26	*	25	25				.004096	.064
.094	.008836	27	27	*	*	26	26	*	25			.004020	.063
.093	.008649	28	*	27	27	*	*	26	*	25		.003931	.063
.092	.008464	*	28	28	*	27	27	*	26	*	25	.003844	.062
.091	.008281	29	29	*	28	28	*	27	*	26	26	.003758	.061
.090	.008100	*	*	29	29	*	28	28	27	27	*	.003684	.061
.089	.007921	30	30	30	*	29	29	*	28	*	27	.003600	.060
.088	.007744	31	31	*	30	30	*	29	*	28	*	.003516	.059
.087	.007569	32	*	31	31	*	30	*	29	29	28	.003434	.059
.086	.007396	*	32	32	*	31	31	30	30	*	29	.003364	.058
.085	.007225	33	33	*	32	32	*	31	*	30	*	.003283	.057
.084	.007056	34	34	33	33	33	32	32	31	31	30	.003204	.057
.083	.006889	35	*	34	34	*	33	*	32	*	31	.003125	.056
.082	.006724	36	35	35	35	34	34	33	33	32	32	.003058	.055
.081	.006561	37	36	36	*	35	35	34	34	33	33	.002981	.055
.080	.006400	*	37	37	36	36	*	35	*	34	*	.002905	.054
.079	.006241	38	38	38	37	37	36	36	35	35	34	.002830	.053
.078	.006084	39	39	39	38	38	37	37	36	36	35	.002767	.053
.077	.005929	41	40	40	39	39	38	38	37	37	36	.002694	.052
.076	.005776	42	41	41	40	40	39	39	38	38	37	.002621	.051
.075	.005625	43	42	42	41	41	40	40	39	39	38	.002550	.051
.074	.005476	44	44	43	43	42	42	41	40	40	39	.002490	.050
.072	.005329	45	45	44	44	43	43	42	42	41	40	.002421	.049
.072	.005184	46	46	46	45	45	44	43	43	42	41	.002352	.049
.071	.005041	48	47	47	46	46	45	45	44	43	43	.002285	.048
.070	.004900	49	49	48	48	47	47	46	45	45	44	.002228	.047
.069	.004761	51	50	50	49	49	48	47	47	46	45	.002162	.047
.068	.004624	52	52	51	51	50	49	49	48	47	46	.002098	.046
.067	.004489	54	53	53	52	52	51	50	49	49	48	.002034	.045
.066	.004356	55	55	54	54	53	53	52	51	50	49	.001980	.045
.065	.004225	57	57	56	56	55	54	53	53	52	51	.001918	.044
.064	.004096	59	58	58	57	57	56	55	54	53	53	.001858	.043
.063	.003969	61	60	60	59	58	58	57	56	55	54	.001798	.042
.062	.003844	63	62	62	61	60	60	59	58	57	56	.001747	.042
.061	.003721	65	64	64	63	62	62	61	60	59	58	.001689	.041
.060	.003600	67	67	66	65	65	64	63	62	61	60	.001632	.040
.059	.003481	70	69	68	68	67	66	65	64	63	62	.001576	.040
.058	.003364	72	71	71	70	69	68	67	66	65	64	.001529	.039
.057	.003249	75	74	73	73	72	71	70	69	68	67	.001475	.038
.056	.003136	77	77	76	75	74	73	72	71	70	69	.001421	.038
.055	.003025	80	80	79	78	77	76	75	74	73	72	.001369	.037
.054	.002916	83	83	82	81	80	79	78	77	76	74	.001325	.036
.053	.002809	87	86	85	84	83	82	81	80	78	77	.001274	.036
.052	.002704	90	89	88	87	86	85	84	83	82	80	.001225	.035
.051	.002601	94	93	92	91	90	89	87	86	85	83	.001176	.034

Edgerton's Table of Standard Errors—Continued

σ_p	σ^2_p	40–60%	39–61%	38–62%	37–63%	36–64%	35–65%	34–66%	33–67%	32–68%	31–69%	PE^2_p	PE_p
.050	.002500	97	97	96	95	94	92	91	90	88	87	.001136	.034
.049	.002401	102	101	100	99	97	96	95	93	92	90	.001089	.033
.048	.002304	106	105	104	103	102	100	99	97	96	94	.001043	.032
.047	.002209	110	110	108	107	106	105	103	102	100	98	.001005	.032
.046	.002116	115	114	113	112	111	109	108	106	105	103	.000961	.031
.045	.002025	121	120	118	117	116	114	113	111	109	108	.000918	.030
.044	.001936	126	125	124	123	121	120	118	116	114	113	.000876	.030
.043	.001849	132	131	130	129	127	125	124	122	120	118	.000841	.029
.042	.001764	139	138	136	135	133	132	130	128	126	124	.000801	.028
.041	.001681	146	145	143	142	140	138	136	134	132	130	.000762	.028
.040	.001600	153	152	151	149	147	145	143	141	139	137	.000724	.027
.039	.001521	161	160	158	157	155	153	151	149	146	144	.000692	.026
.038	.001444	170	169	167	165	163	161	159	157	154	152	.000655	.026
.037	.001369	180	178	176	174	172	170	168	165	163	160	.000620	.025
.036	.001296	190	188	186	184	182	180	178	175	172	169	.000586	.024
.035	.001225	201	199	197	195	193	191	188	185	182	179	.000557	.024
.034	.001156	213	211	209	207	205	202	199	197	193	190	.000524	.023
.033	.001089	227	225	223	220	218	215	212	209	206	202	.000493	.022
.032	.001024	241	239	237	234	232	229	226	222	219	215	.000462	.022
.031	.000961	257	255	253	250	247	244	241	237	233	229	.000437	.021
.030	.000900	275	273	270	267	264	261	257	254	250	245	.000408	.020
.029	.000841	295	292	290	286	283	280	276	272	267	263	.000380	.020
.028	.000784	317	314	311	308	304	300	296	292	287	282	.000353	.019
.027	.000729	341	338	335	331	328	323	319	314	309	304	.000331	.018
.026	.000676	369	365	362	358	354	349	345	340	334	328	.000306	.018
.025	.000625	399	396	392	388	383	379	373	368	362	356	.000282	.017
.024	.000576	434	430	426	422	417	411	406	400	394	387	.000259	.016
.023	.000529	474	469	465	460	455	449	443	436	429	422	.000240	.016
.022	.000484	519	514	509	504	498	492	485	478	470	462	.000219	.015
.021	.000441	571	566	560	554	548	541	533	526	517	508	.000199	.014
.020	.000400	631	625	619	613	605	598	590	581	572	562	.000180	.013
.019	.000361	701	695	688	681	673	664	655	646	635	624	.000164	.013
.018	.000324	783	776	769	761	752	742	732	721	710	698	.000146	.012
.017	.000289	881	873	865	856	846	835	824	812	799	785	.000130	.011
.016	.000256	998	990	980	970	959	946	934	920	905	890	.000114	.011
.015	.000225	1141	1131	1120	1108	1095	1082	1067	1051	1034	1017	.000102	.010
.014	.000196	1316	1305	1292	1279	1264	1248	1231	1213	1193	1173	.000088	.009
.013	.000169	1536	1522	1507	1491	1474	1456	1436	1415	1392	1368	.000076	.009
.012	.000144	1814	1798	1781	1762	1742	1720	1696	1671	1645	1617	.000064	.008
.011	.000121	2176	2157	2137	2114	2089	2063	2035	2005	1973	1940	.000054	.007
.010	.000100	2659	2636	2610	2582	2552	2520	2486	2449	2411	2370	.000045	.007
.009	.000081	3321	3292	3260	3226	3188	3148	3105	3060	3011	2960	.000036	.006
.008	.000064	4266	4229	4188	4143	4095	4044	3989	3930	3868	3802	.000028	.005
.007	.000049	5680	5630	5576	5517	5453	5384	5311	5233	5150	5062	.000022	.005
.006	.000036	7933	7864	7788	7705	7616	7520	7418	7309	7193	7071	.000016	.004
.005	.000025	11851	11748	11634	11511	11377	11234	11081	10918	10745	10562	.000011	.003
.004	.000016	19591	19420	19232	19028	18808	18571	18318	18048	17763	17461	.000007	.003
.003	.000009	38400	38064	37696	37296	36864	36400	35904	35376	34816	34224	.000004	.002
.002	.000004	106666	105733	104711	103599	102399	101111	99733	98266	96711	95066	.000002	.001
.001	.000001	996000	951600	942400	923400	921600	910000	897600	884400	870400	855600	.000000	.001
σ_p	σ^2_p	40–60%	39–61%	38–62%	37–63%	36–64%	35–65%	34–66%	33–67%	32–68%	31–69%	PE^2_p	PE_p

Edgerton's Table of Standard Errors—Continued

σ_p	σ^2_p	30–70%	29–71%	28–72%	27–73%	26–74%	25–75%	24–76%	23–77%	22–78%	21–79%	PE'_p	PE_p
.100	.010000											.004543	.067
.099	.009801											.004449	.067
.098	.009604											.004369	.066
.097	.009409											.004277	.065
.096	.009126											.004186	.065
.095	.009025											.004096	.064
.094	.008836											.004020	.063
.093	.008649											.003931	.063
.092	.008464	25										.003844	.062
.091	.008281	*	25									.003758	.061
.090	.008100	26	*	25								.003684	.061
.089	.007921	*	26	*	25							.003600	.060
.088	.007744	27	*	26	*	25						.003516	.059
.087	.007569	28	27	*	26	*	25					.003434	.059
.086	.007396	*	28	27	*	26	*					.003364	.058
.085	.007225	29	*	28	27	*	26	25				.003283	.057
.084	.007056	30	29	*	28	27	*	26	25			.003204	.057
.083	.006889	*	30	29	*	28	27	*	26	25		.003125	.056
.082	.006724	31	*	30	29	*	28	27	*	*		.003058	.055
.081	.006561	32	31	31	30	29	*	28	27	26	25	.002981	.055
.080	.006400	33	32	*	31	30	29	*	28	27	26	.002905	.054
.079	.006241	34	33	32	*	31	30	29	*	*	*	.002830	.053
.078	.006084	*	34	33	32	32	31	30	29	28	27	.002767	.053
.077	.005929	35	35	34	33	*	32	31	30	29	28	.002694	.052
.076	.005776	36	36	35	34	33	*	*	31	30	29	.002621	.051
.075	.005625	37	37	36	35	34	33	32	*	*	*	.002550	.051
.074	.005476	38	38	37	36	35	34	33	32	31	30	.002490	.050
.073	.005329	39	39	38	37	36	35	34	33	32	31	.002421	.049
.072	.005184	41	40	39	38	37	36	35	34	33	32	.002352	.049
.071	.005041	42	41	40	39	38	37	36	35	34	33	.002285	.048
.070	.004900	43	42	41	40	39	38	37	36	35	34	.002228	.047
.069	.004761	44	43	42	42	41	39	38	37	36	35	.002162	.047
.068	.004624	46	45	44	43	42	41	40	38	37	36	.002098	.046
.067	.004489	47	46	45	44	43	42	41	40	38	37	.002034	.045
.066	.004356	48	47	46	45	44	43	42	41	39	38	.001980	.045
.065	.004225	50	49	48	47	46	45	43	42	41	39	.001918	.044
.064	.004096	52	51	49	48	47	46	45	43	42	41	.001858	.043
.063	.003969	53	52	51	50	49	48	46	45	43	42	.001798	.042
.062	.003844	55	54	53	52	50	49	48	46	45	43	.001747	.042
.061	.003721	57	56	55	53	52	51	49	48	46	45	.001689	.041
.060	.003600	59	58	56	55	54	52	51	50	48	46	.001632	.040
.059	.003181	61	60	58	57	56	54	53	51	50	48	.001576	.040
.058	.003364	63	62	60	59	58	56	55	53	51	50	.001529	.039
.057	.003249	65	64	63	61	60	58	57	55	53	51	.001475	.038
.056	.003136	68	66	65	63	62	60	59	57	55	53	.001421	.038
.055	.003025	70	69	67	66	64	63	61	59	57	55	.001369	.037
.054	.002916	73	71	70	68	67	65	63	61	59	57	.001325	.036
.053	.002809	76	74	73	71	69	68	66	64	62	60	.001274	.036
.052	.002704	79	77	76	74	72	70	68	66	64	62	.001225	.035
.051	.002601	82	80	79	77	75	73	71	69	67	65	.001176	.034

Edgerton's Table of Standard Errors—Continued

σ_p	σ^2_p	30–70%	29–71%	28–72%	27–73%	26–74%	25–75%	24–76%	23–77%	22–78%	21–79%	PE^2_p	PE_p
.050	.002500	85	84	82	80	78	76	74	72	70	67	.001136	.034
.049	.002401	89	87	85	83	81	79	77	75	72	70	.001089	.033
.048	.002304	93	91	89	87	85	83	80	78	76	73	.001043	.032
.047	.002209	97	95	93	91	88	86	84	81	79	76	.001005	.032
.046	.002116	101	99	97	95	92	90	88	85	82	80	.000961	.031
.045	.002025	106	103	101	99	97	94	92	89	86	83	.000918	.030
.044	.001936	110	108	106	104	101	99	96	93	90	87	.000876	.030
.043	.001849	116	113	111	109	106	103	100	98	95	91	.000841	.029
.042	.001764	121	119	117	114	111	108	105	102	99	96	.000801	.028
.041	.001681	128	125	122	120	117	114	111	107	104	101	.000762	.028
.040	.001600	134	131	129	126	123	120	116	113	109	106	.000724	.027
.039	.001521	141	138	136	132	129	126	123	119	115	111	.000692	.026
.038	.001444	149	146	143	140	136	133	129	125	122	117	.000655	.026
.037	.001369	157	154	151	147	144	140	136	132	128	124	.000620	.025
.036	.001296	166	163	159	156	152	148	144	140	136	131	.000586	.024
.035	.001225	176	172	169	165	161	157	153	148	144	139	.000557	.024
.034	.001156	187	183	179	175	171	167	162	157	152	147	.000524	.023
.033	.001089	198	194	190	186	182	177	172	167	162	157	.000493	.022
.032	.001024	211	207	203	198	193	188	183	178	172	167	.000462	.022
.031	.000961	225	221	216	211	206	201	196	190	184	178	.000437	.021
.030	.000900	241	236	231	226	221	215	209	203	197	190	.000408	.020
.029	.000841	258	253	248	242	236	230	224	218	211	204	.000380	.020
.028	.000784	277	272	266	260	254	247	241	234	226	219	.000353	.019
.027	.000729	299	293	287	280	273	266	259	252	244	236	.000331	.018
.026	.000676	322	316	310	303	295	288	280	272	263	255	.000306	.018
.025	.000625	349	343	335	328	320	312	303	295	285	276	.000282	.017
.024	.000576	380	372	365	356	348	339	330	320	310	300	.000259	.016
.023	.000529	414	406	398	389	380	370	360	349	338	327	.000240	.016
.022	.000484	454	445	436	426	416	405	394	383	371	358	.000219	.015
.021	.000441	499	489	479	469	457	446	434	421	408	394	.000199	.014
.020	.000400	552	541	530	518	505	493	479	465	451	436	.000180	.013
.019	.000361	613	601	589	575	562	547	532	517	501	484	.000164	.013
.018	.000324	685	672	658	643	628	612	595	578	560	541	.000146	.012
.017	.000289	771	756	740	723	706	688	669	650	630	609	.000130	.011
.016	.000256	874	857	839	822	800	780	759	737	714	690	.000114	.011
.015	.000225	998	979	958	937	915	891	867	842	816	789	.000102	.010
.014	.000196	1152	1129	1106	1081	1055	1028	1000	971	941	910	.000088	.009
.013	.000169	1344	1317	1290	1261	1231	1200	1167	1133	1098	1061	.000076	.009
.012	.000144	1587	1556	1524	1490	1454	1417	1379	1339	1297	1254	.000064	.008
.011	.000121	1904	1867	1828	1787	1745	1700	1654	1606	1556	1504	.000054	.007
.010	.000100	2326	2281	2233	2183	2131	2077	2021	1962	1901	1838	.000045	.007
.009	.000081	2906	2849	2790	2728	2662	2595	2524	2451	2375	2296	.000036	.006
.008	.000064	3733	3660	3583	3503	3420	3333	3242	3148	3050	2949	.000028	.005
.007	.000049	4970	4873	4771	4665	4553	4437	4317	4191	4061	3926	.000022	.005
.006	.000036	6942	6806	6664	6516	6360	6198	6029	5854	5672	5484	.000016	.004
.005	.000025	10370	10167	9955	9733	9501	9259	9007	8745	8474	8192	.000011	.003
.004	.000016	17142	16808	16457	16089	15706	15306	14889	14457	14008	13542	.000007	.003
.003	.000009	33600	32994	32256	31536	30784	30000	29184	28336	27456	26544	.000004	.002
.002	.000004	93333	91511	89599	87599	85511	83333	81066	78711	76266	73733	.000002	.001
.001	.000001	840000	823600	806400	788400	768600	750000	729600	708400	686400	663600	.000000	.001
σ_p	σ^2_p	30–70%	29–71%	28–72%	27–73%	26–74%	25–75%	24–76%	23–77%	22–78%	21–79%	PE^2_p	PE_p

Edgerton's Table of Standard Errors—Continued

σ_p	σ^2_p	20–80%	19–81%	18–82%	17–83%	16–84%	15–85%	14–86%	13–87%	12–88%	11–89%	PE^2_p	PE_p
.100	.010000											.004543	.067
.099	.009801											.004449	.067
.098	.009604											.004369	.066
.097	.009409											.004277	.065
.096	.009126											.004186	.065
.095	.009025											.004096	.064
.094	.008836											.004020	.063
.093	.008649											.003931	.063
.092	.008464											.003844	.062
.091	.008281											.003758	.061
.090	.008100											.003684	.061
.089	.007921											.003600	.060
.088	.007744											.003516	.059
.087	.007569											.003434	.059
.086	.007396											.003364	.058
.085	.007225											.003283	.057
.084	.007056											.003204	.057
.083	.006889											.003125	.056
.082	.006724											.003058	.055
.081	.006561											.002981	.055
.080	.006400	25										.002905	.054
.079	.006241	•										.002830	.053
.078	.006084	26	25									.002767	.053
.077	.005929	27	26	25								.002694	.052
.076	.005776	28	•	•								.002621	.051
.075	.005625	•	27	26	25							.002550	.051
.074	.005476	29	28	27	26							.002490	.050
.073	.005329	30	29	28	•	25						.002421	.049
.072	.005184	31	30	•	27	26						.002352	.049
.071	.005041	32	•	29	28	27	25					.002285	.048
.070	.004900	33	31	30	29	•	26					.002228	.047
.069	.004761	34	32	31	30	28	27	25				.002162	.047
.068	.004624	35	33	32	•	29	•	26				.002098	.046
.067	.004489	36	34	33	31	30	28	27	25			.002034	.045
.066	.004356	37	35	34	32	31	29	28	26			.001980	.045
.065	.004225	38	36	35	33	32	30	•	27	25		.001918	.044
.064	.004096	39	38	36	34	33	31	29	28	26		.001858	.043
.063	.003969	40	39	37	36	34	32	30	•	27	25	.001798	.042
.062	.003844	42	40	39	37	35	33	31	29	•	•	.001747	.042
.061	.003721	43	42	40	38	36	34	32	30	28	26	.001689	.041
.060	.003600	45	43	41	39	37	36	34	31	29	27	.001632	.040
.059	.003481	46	44	43	41	39	37	35	33	30	28	.001576	.040
.058	.003364	48	46	44	42	40	38	36	34	31	29	.001529	.039
.057	.003249	50	48	46	44	42	39	37	35	33	30	.001475	.038
.056	.003136	51	49	47	45	43	41	39	36	34	31	.001421	.038
.055	.003025	53	51	49	47	45	42	40	38	35	32	.001369	.037
.054	.002916	55	53	51	49	46	44	42	39	36	34	.001325	.036
.053	.002809	58	55	53	51	48	46	43	41	38	35	.001274	.036
.052	.002704	60	58	55	53	50	48	45	42	39	36	.001225	.035
.051	.002601	62	60	57	55	52	49	47	44	41	38	.001176	.034

Edgerton's Table of Standard Errors—Continued

σ_p	$\sigma_p{}^2$	20–80%	19–81%	18–82%	17–83%	16–84%	15–85%	14–86%	13–87%	12–88%	11–89%	$PE^2{}_p$	PE_p
.050	.002500	65	62	60	57	54	52	49	46	43	39	.001136	.034
.049	.002401	68	65	62	59	57	54	51	48	44	41	.001089	.033
.048	.002304	70	68	65	62	59	56	53	50	46	43	.001043	.032
.047	.002209	73	71	68	65	62	58	55	52	48	45	.001005	.031
.046	.002116	77	74	71	68	64	61	58	54	51	47	.000961	.031
.045	.002025	80	77	74	71	67	64	60	57	53	49	.000918	.030
.044	.001936	84	81	78	74	71	67	63	59	55	51	.000876	.030
.043	.001849	88	85	81	78	74	70	66	62	58	54	.000841	.029
.042	.001764	92	89	85	81	78	74	69	65	61	56	.000801	.028
.041	.001681	97	93	89	86	81	77	73	68	64	59	.000762	.028
.040	.001600	102	98	94	90	86	81	77	72	67	62	.000724	.027
.039	.001521	107	103	99	95	90	86	81	76	71	66	.000692	.026
.038	.001444	113	109	104	100	95	90	85	80	75	69	.000655	.026
.037	.001369	120	115	110	105	100	95	90	84	79	73	.000620	.025
.036	.001296	126	122	117	111	106	101	95	89	83	77	.000586	.024
.035	.001225	134	129	124	118	112	107	101	95	88	82	.000557	.024
.034	.001156	142	137	131	125	119	113	107	100	94	87	.000524	.023
.033	.001089	151	145	139	133	127	120	113	107	99	92	.000193	.022
.032	.001024	161	155	148	142	135	128	121	113	106	98	.000462	.022
.031	.000961	171	165	158	151	144	137	129	121	113	105	.000437	.021
.030	.000900	183	176	169	162	154	146	138	129	121	112	.000408	.020
.029	.000841	196	189	181	173	165	156	148	139	130	120	.000380	.020
.028	.000784	211	203	195	186	177	168	159	149	139	129	.000353	.019
.027	.000729	227	219	210	200	191	181	171	161	150	139	.000331	.018
.026	.000676	246	236	226	216	206	196	185	173	162	150	.000306	.018
.025	.000625	266	256	245	235	223	212	200	188	175	163	.000282	.017
.024	.000576	289	278	267	255	243	230	218	204	191	177	.000259	.016
.023	.000529	316	303	291	278	265	251	237	223	208	193	.000240	.016
.022	.000484	346	332	319	305	290	275	260	244	228	211	.000219	.015
.021	.000441	380	366	351	335	319	303	286	269	251	232	.000199	.014
.020	.000400	420	404	388	371	353	335	316	297	277	257	.000180	.013
.019	.000361	467	449	431	412	392	372	351	330	308	286	.000164	.013
.018	.000324	522	502	481	460	438	416	393	369	344	309	.000146	.012
.017	.000289	587	565	542	518	493	468	442	415	387	359	.000130	.011
.016	.000256	665	640	614	587	559	530	501	470	439	407	.000114	.011
.015	.000225	760	731	702	671	639	606	572	537	502	465	.000102	.010
.014	.000196	877	844	809	774	737	699	660	620	579	537	.000088	.009
.013	.000169	1024	984	944	903	860	816	770	723	675	626	.000076	.009
.012	.000144	1209	1163	1116	1066	1016	964	910	855	798	740	.000064	.008
.011	.000121	1451	1395	1338	1279	1219	1156	1092	1025	957	887	.000054	.007
.010	.000100	1772	1705	1635	1563	1489	1412	1334	1253	1170	1084	.000045	.007
.009	.000081	2214	2130	2042	1952	1860	1764	1666	1565	1461	1355	.000036	.006
.008	.000064	2844	2735	2623	2508	2389	2266	2140	2010	1877	1740	.000028	.005
.007	.000049	3786	3642	3493	3339	3181	3017	2849	2676	2499	2317	.000022	.005
.006	.000036	5289	5087	4879	4664	4442	4214	3980	3738	3490	3236	.000016	.004
.005	.000025	7901	7599	7288	6967	6637	6296	5946	5585	5214	4834	.000011	.003
.004	.000016	13061	12563	12048	11518	10971	10408	9828	9232	8620	7991	.000007	.003
.003	.000009	25600	24624	23616	22576	21504	20400	19264	18096	16896	15664	.000004	.002
.002	.000004	71111	68399	65599	62711	59733	56666	53511	50266	46933	43511	.000002	.001
.001	.000001	640000	615600	590400	564400	537600	510000	481600	452400	422400	391600	.000000	.001
σ_p	$\sigma^2{}_p$	20–80%	19–81%	18–82%	17–83%	16–84%	15–85%	14–86%	13–87%	12–88%	11–89%	$PE^2{}_p$	PE_p

Edgerton's Table of Standard Errors—Continued

σ_p	σ^2_p	10–90%	9–91%	8–92%	7–93%	6–94%	5–95%	4–96%	3–97%	2–98%	1–99%	PE^2_p	PE_p
.100	.010000											.004543	.067
.099	.009801											.004449	.067
.098	.009604											.004369	.066
.097	.009409											.004277	.065
.096	.009126											.004186	.065
.096	.009025											.004096	.064
.094	.008836											.004020	.063
.093	.008649											.003931	.063
.092	.008464											.003844	.062
.091	.008281											.003758	.061
.090	.008100											.003684	.061
.089	.007921											.003600	.060
.088	.007744											.003516	.059
.087	.007569											.003434	.059
.086	.007396											.003364	.058
.085	.007225											.003283	.057
.084	.007056											.003204	.057
.083	.006889											.003125	.056
.082	.006724											.003058	.055
.081	.006561											.002981	.055
.080	.006400											.002905	.054
.079	.006241											.002830	.053
.078	.006084											.002767	.053
.077	.005929											.002694	.052
.076	.005776											.002621	.051
.075	.005625											.002550	.051
.074	.005476											.002490	.050
.073	.005329											.002421	.049
.072	.005184											.002352	.049
.071	.005041											.002285	.048
.070	.004900											.002228	.047
.069	.004761											.002162	.047
.068	.004624											.002098	.046
.067	.004489											.002034	.045
.066	.004356											.001980	.045
.065	.004225											.001918	.044
.064	.004096											.001858	.043
.063	.003969											.001798	.042
.062	.003844											.001747	.042
.061	.003721											.001689	.041
.060	.003600	25										.001632	.040
.059	.003481	26										.001576	.040
.058	.003364	27										.001529	.039
.057	.003249	28	25									.001475	.038
.056	.003136	29	26									.001421	.038
.055	.003025	30	27									.001369	.037
.054	.002916	31	28	25								.001325	.036
.053	.002809	32	29	26								.001274	.036
.052	.002704	33	30	27								.001225	.035
.051	.002601	35	32	28	25							.001176	.034

Edgerton's Table of Standard Errors—Concluded

σ_p	σ^2_p	10–90%	9–91%	8–92%	7–93%	6–94%	5–95%	4–96%	3–97%	2–98%	1–99%	PE^2_p	PE_p
.050	.002500	36	33	30	26							.001136	.034
.049	.002401	38	34	31	27							.001089	.033
.048	.002304	39	36	32	28							.001043	.032
.047	.002209	41	37	34	30	26						.001005	.032
.046	.002116	43	39	35	31	27						.000961	.031
.045	.002025	45	41	37	32	28						.000918	.030
.044	.001936	47	43	38	34	29	25					.000876	.030
.043	.001849	49	45	40	36	31	26					.000841	.029
.042	.001764	52	47	42	37	32	27					.000801	.028
.041	.001681	54	49	44	39	34	28					.000762	.028
.040	.001600	57	52	47	41	36	30					.000724	.027
.039	.001521	60	55	49	43	38	32	25				.000692	.026
.038	.001444	63	58	52	46	40	33	27				.000655	.026
.037	.001369	67	61	55	48	42	35	28				.000620	.025
.036	.001296	71	64	58	51	44	37	30				.000586	.024
.035	.001225	75	68	61	54	47	39	32				.000557	.024
.034	.001156	80	72	65	58	50	42	33	25			.000524	.023
.033	.001089	85	77	69	61	53	44	36	27			.000493	.022
.032	.001024	90	82	74	65	56	47	38	29			.000462	.022
.031	.000961	96	88	79	69	60	51	40	31			.000437	.021
.030	.000900	103	94	84	74	64	54	43	33			.000408	.020
.029	.000841	110	100	90	80	69	58	46	35			.000380	.020
.028	.000784	119	108	97	86	74	62	50	38	25		.000353	.019
.027	.000729	128	116	104	92	80	67	54	41	27		.000331	.018
.026	.000676	138	125	113	100	86	73	58	44	30		.000306	.018
.025	.000625	149	136	122	108	93	79	63	48	32		.000282	.017
.024	.000576	162	148	133	117	102	86	68	52	35		.000259	.016
.023	.000529	177	161	145	128	111	93	75	57	38		.000240	.016
.022	.000484	194	177	159	140	122	102	82	62	42		.000219	.015
.021	.000441	214	194	175	154	134	113	90	69	46		.000199	.014
.020	.000400	236	215	193	171	148	124	100	76	51	26	.000180	.013
.019	.000361	262	239	215	190	164	138	111	85	57	28	.000164	.013
.018	.000324	293	267	240	212	184	155	124	95	63	32	.000146	.012
.017	.000289	330	300	270	239	207	174	139	106	71	36	.000130	.011
.016	.000256	374	340	306	270	234	197	158	121	81	41	.000114	.011
.015	.000225	428	389	350	309	268	225	181	138	93	47	.000102	.010
.014	.000196	493	449	403	357	309	260	209	159	107	54	.000088	.009
.013	.000169	576	524	471	416	360	304	243	186	125	63	.000076	.009
.012	.000144	680	619	556	492	426	359	288	220	148	74	.000064	.008
.011	.000121	816	742	667	590	511	430	345	263	177	89	.000054	.007
.010	.000100	997	907	815	721	624	526	422	322	217	109	.000045	.007
.009	.000081	1245	1133	1018	901	780	657	527	402	271	137	.000036	.006
.008	.000064	1599	1455	1308	1157	1002	844	677	517	348	175	.000028	.005
.007	.000049	2130	1938	1742	1540	1334	1124	901	688	463	234	.000022	.005
.006	.000036	2975	2707	2433	2152	1864	1570	1259	961	647	327	.000016	.004
.005	.000025	4444	4044	3634	3214	2785	2345	1881	1437	967	488	.000011	.003
.004	.000016	7346	6685	6008	5314	4604	3877	3110	2375	1599	808	.000007	.003
.003	.000009	14400	13104	11776	10416	9024	7600	6096	4656	3136	1581	.000004	.002
.002	.000004	39999	36399	32711	28933	25288	21111	16933	12933	8711	4399	.000002	.001
.001	.000001	360000	327600	294400	260400	225600	190000	152400	116400	78400	39600	.000000	.001
σ_p	σ^2_p	10–90%	9–91%	8–92%	7–93%	6–94%	5–95%	4–96%	3–97%	2–98%	1–99%	PE^2_p	PE_p

USE OF THE TABLE

Problem: To determine the σ_p, σ_p^2, PE_p and PE^2_p in the case where 17 out of 34 cases reacted in a certain way. The percentage is 50 per cent and the number of cases is 34. Look at the first entry in the horizontal row at the top of the table, i.e., 50–50 per cent. Then look down the column under that entry until 34, the number of cases, is found. (In case the exact n is not given in the table, use the n next higher). Then reading to the left the σ_p value is found to be 0.086, and its square to be 0.007396. In the last column reading to the right is found a PE_p value of 0.058 and a PE^2_p value of 0.003364. Expressing these values in percentages rather than in decimals the following statement may be made. The standard error of 50 per cent, where the number of cases is 34, is 8.6 per cent, the square of the standard error is 65.61 per cent, the probable error is 5.8 per cent and the square of the probable error is 33.64 per cent. These values can then be used in determining the statistical significance of the difference between this percentage based on 34 cases and any other percentage based on any number of cases.

Problem: To determine the significance of the difference between two percentages (p_1 and p_2) the first showing 50 per cent of a group of 34 reacting in a certain way and the second showing 42 per cent of a group of 73 cases reacting in the same way. We have our σ_p and $\sigma_{p_1}^2$ values for the first group as shown above (i.e., 0.086 and 0.007396). The σ_p^2 value for the second group is obtained by looking across the top of the table to the ninth column (42–58%), looking down that column and locating 73 (the number of cases), and then looking across to the left to the first column and finding the σ_p^2 which is 0.058, its square being 0.003364.

The formula[3] for determining the standard error of the difference is:

$$\sigma_{diff.} = \sqrt{\sigma_{p_1}^2 + \sigma_{p_2}^2}$$

[3] G. U. Yule: An Introduction to the Theory of Statistics, 1924, p. 269, formula (6).

Substituting our obtained values in the above formula we have:

$$\sigma_{diff.} = \sqrt{0.007396 + 0.003364} = \sqrt{0.010760} = 0.103$$

This value of 0.103 can then be related to the difference which was 0.080, to show the ratio of the obtained difference to the standard error of the difference. In this case the difference is found not to be statistically significant since it is smaller than the standard error of the difference.

It is obvious that if the formula for the probable error of the difference, i.e., $PE_{diff.} = \sqrt{PE^2_{p_1} + PE^2_{p_2}}$, is used one need only refer to the last two columns of the table and substitute these PE_p values in a similar manner.

A CORRECTION

Attention of subscribers and readers of the JOURNAL OF APPLIED PSYCHOLOGY is called to a regrettable and serious error made in the September issue for 1925, page 222. In order to correct this we are reprinting Table 1 of the article by Miss Constance T. Dowd and Dr. Ada Hart Arlitt on "Relative Effects of Play and Gymnastics."

TABLE 1

*Difference in average gains of experimental and control groups**

	AVERAGE GAIN		DIFFERENCE	P.E.	DIFFERENCE IN P.E. UNITS
	Formal Gymnastic Group	Supervised Play Group			
Cancellation	7.88	8.05	−0.17	1.27	−0.14
Card Sorting	4.50	4.79	−0.29	1.42	−0.20
Tapping, right	9.33	8.06	1.27	3.24	0.39
Tapping, left	1.22	6.16	−4.94	3.99	−1.24
Weight Lifting	−0.03	0.23	−0.26	2.72	−0.97
Balance Line	0.05	1.35	−1.30	0.77	−1.68
Bean Bags	−3.22	−7.29	4.07	1.86	2.18
Hopping	0.61	0.41	0.20	0.72	0.28
Target	2.94	3.05	−0.11	1.20	−0.09
Vital Capacity	4.11	2.41	1.70	2.21	0.77
Hand Grip, right	2.89	5.47	−2.58	1.76	−1.46
Hand Grip, left	0.61	2.41	−1.80	1.37	−1.31
Baseball Throw	−63.88	11.02	−74.90	40.46	−1.85
Basket Ball Throw	−6.11	16.76	−22.87	15.36	−1.49
Dash	0.00	0.08	−0.08	0.13	−0.61
Hop, Step and Jump	17.50	10.26	7.24	4.65	1.55
High Jump	3.94	3.35	0.59	0.77	0.76
Running Broad Jump	20.66	22.94	−2.28	2.49	−0.91
Standing Broad Jump	2.61	1.76	0.85	1.04	0.81

NOTES AND NEWS

Dr. Gordon W. Allport (Harvard) has been appointed Assistant Professor of Psychology in Dartmouth College.

Prof. Mark May who has been on leave for research on character testing at Columbia will return to Syracuse University in the fall of 1927 to engage in research work on personnel problems and administration.

Prof. F. H. Allport of Syracuse University reports survey of student opinion upon 75 items of college life. Results are now being compiled from 4250 cases. The reaction scale in form and content is largely psychological. Results promise some application to political psychology. Scales for measuring personality traits are being devised by Profs. G. W. and F. H. Allport.

Director Emily Burr, Vocational Adjustment Bureau, 336 E. 19th Street, New York, reports personnel as follows: Alice Bessey and Mona Jacobs, Placement Counselors; Katherine Treat, Research Worker; Edna Unger, Industrial Expert; Ella Doux, Director of Workshop for Neurotic and Psychopathic Girls. An "Industrial Calendar" is the result of the most recent research.

Prof. William M. Brown, Washington & Lee University, Lexington, Va., is serving as Psychological Examiner and Vocational Advisor and is also head of the Department of Psychology. Walter A. Flick is Assistant Professor of Psychology.

Dr. Elsie O. Bregman of the Psychological Corporation will publish shortly a comparative study of character traits in women secretaries, chemists, lawyers, statisticians and department store workers for the Bureau of Vocational Information, N. Y.

Prof. Mary Stuart, Psychology, Durham University, England, delivered two lectures to the Summer School students, University of Colorado.

Prof. L. W. Cole, University of Colorado, is the author of a new text book, "Factors of Human Psychology," already adopted by several colleges.

Dr. George Van Ness Dearborn, Director, laboratory of Medical Psychology, United States Veterans' Hospital, Kingsbridge, N. Y., recently read a paper before the American Psychiatric Association on a new method for determining intellectual regression in the psychotic and psychoneurotic as an aid to diagnosis and prognosis. It is reported that this is the only laboratory of its kind in the Veterans' Bureau.

Dr. S. I. Franz, University of California, Southern Branch, reports the promotion of Dr. Ellen B. Sullivan to the rank of assistant professor.

Dr. Thomas R. Garth is director of three expeditions to the Indian reservations, Rosebud, Pine Ridge and Chilocco, made for the purpose of studying intelligence, school achievement and musical talent. Mexicans of New Mexico have been tested in the same ways.

Gladys M. Love has resigned from the Judge Baker Foundation, Boston, to become school psychologist, Montclair, N. J.

The staff of this Foundation will soon publish a Manual of Mental Tests which will include many thorough standardizations made possible by extensive coöperation.

Dr. W. A. Brownell, formerly of the University of Illinois, has been appointed Assistant Professor, University Division of Education, Cornell University. He will give courses in Psychology to students of hotel administration and do research in hotel personnel.

Dr. G. H. Miles, Assistant Director of the National Institute of Industrial Psychology, London, is lecturing this summer at Columbia University on Industrial Psychology in England. Dr. Mary H. S. Hayes, Director of the Vocational Service for Juniors, New York, is conducting a course in Columbia on the Technique of Counselling and Placement.

Dr. Carney Landis for two years National Research Fellow in the Biological Sciences (Psychology) has been appointed Assistant Professor of Psychology, Wesleyan University, Conn. During the present summer he has been investigating skin resistance during sleep for the Simmons Fellowship at Mellon Institute for Industrial Research, University of Pittsburgh.

Prof. Franklin Fearing, Stanford, has been appointed Associate Professor of Psychology, Ohio Wesleyan University. Prof. Kate Gordon, University of California, Southern Branch, was lecturer at Stanford University during the summer quarter.

The Western Psychological Association met at Mills College, June 18–19, 1926. Prof. Kate Gordon was elected president.

"Mental Training for the Pre-School Age Child" by Lillien J. Martin and Clair de Gruchy has reached its second edition.

The Catholic University of America, Washington, D. C., announces the publication of a new series of Monographs by Williams & Wilkins Co., Baltimore, Md. The new studies in Psychology and Psychiatry, No. 1, "Psychology of Reasoning," by Miriam F. Dunn; No. 2, "Diastatic Activity of the Blood Serum in Mental Disorders," by John W. Rauth.

Dr. Deane B. Judd, Cornell, is now Munsell Research Associate in Colorimetry at the National Bureau of Standards. Prof. E. P. T. Tyndall is engaged during this summer at the National Bureau of Standards in a study of hue sensibility as a function of saturation. The Munsell Research Laboratory, Baltimore, is coöperating with the Bureau of Standards in an investigation of hue sensibility, chromo sensibility and colorimetric standards.

Prof. Karl G. Miller, Psychology, University of Pennsylvania, has been appointed Director of Admissions; also Dr. Robert A. Brotemarkle has been appointed Personnel Officer.

Prof. Edward S. Robinson, Associate Professor of Psychology, University of Chicago, will serve at Yale in the same capacity during the first semester and at Harvard as Lecturer on Psychology during the second semester of next year.

Dr. G. M. Ruch, Associate Professor of Psychology and Education, University of Iowa, has accepted a professorship of Educational Psychology, University of California. He is giving courses during the present summer in Educational Psychology at Chicago.

Chiefly through the energy of Dr. Morton Prince, approximately one hundred thousand dollars for instruction and research in abnormal and dynamic psychology has been received by Harvard University. For the year 1926–27 he has been appointed Associate Professor of Abnormal and Dynamic Psychology. His task will be to organize this new work in order to bring about fundamental scientific research in abnormal psychology and in personality, without any necessary relation to therapeutics or other practical applications.

The Child Clinic, Los Angeles, Calif., will have personnel as follows: E. Van Norman Emery, Director; Julia Mathews, Psychologist; Edith M. Burleigh, Chief of Social Service; Esther Heath, Marjorie Stauffer and Florence Gary, Psychiatric Social Workers.

Dr. A. H. Sutherland, since 1917 Director of Research and Psychologist for the Los Angeles Public Schools, becomes Director of the Scarborough Schools, Scarborough, N. Y., founded and supported by Frank A. Vanderlip. While at Los Angeles Dr. Sutherland built up a department probably larger than any other similar department in this country. At Scarborough he will gradually introduce the methods and organization of work for normal and super-bright children which have attracted such favorable attention in Los Angeles. For years he has demonstrated that children cannot only on the average progress faster but perhaps even raise their IQ's by specially directed exercises.

The School of Education, New York University, announces as full-time personnel Drs. Benson, Skinner, West and Daisy Hetherington, the first-named being chairman. For part-time, Drs. Meta Anderson, Alice Von Bauer, and J. C. Bell.

Skidmore College announces that Intelligence, Emotional and Vocational Tests are given to all students.

Dean Seashore, Graduate College, Iowa, announces that Dr. Oliver A. Ohmann, instructor in Business Psychology for the past two years has accepted an appointment at Western Reserve University. Dr. George Gallop (Iowa) will offer courses in the Psychology of Advertising and Personnel. Dr. Samuel T. Orton has almost ready a new unit for the investigation of reading disabilities of great theoretical and practical significance.

The Research Bureau, State Board of Control, St. Paul, Minn., reports the appointment of Miss Gertrude Tartar formerly in charge of Psychological Clinic at the U. S. Veterans' Hospital, Wakashau, Wis., as Mental Examiner of Research Bureau. Miss Charlotte Lowe, Mental Examiner, has completed an investigation of the intelligence and social background of unmarried mothers.

During the summer quarter the University of Southern California had as additional staff members Drs. Guy M. Whipple, Detroit, and John J. B. Morgan, Northwestern University.

Dr. Eleanor Rowland Wembridge, Psychologist of the Women's Protective Association of Cleveland, has been appointed Referee of the Juvenile Court of that city.

The Iowa Child Welfare Research Station of the University of Iowa is extending its facilities and resources for research in the field of child development. Five divisions of pre-school laboratories were conducted during the past year with ninety infants and young children in daily attendance. During the fall and winter sessions special graduate and post doctorate seminars and research courses will be given in physical growth, nutrition of the child, psychology of childhood, pre-school teaching, and parent education.

Within the past year five doctor's dissertations have been completed and published in the field of the psychology of the young child.

The Research Station in Character Education, University of Iowa, Iowa City, Dr. Edwin D. Starbuck in charge, invites correspondence concerning its achievements in intensive studies of methods of Character Education. The Bureau of Education of New York City after three years of careful study pays this tribute to the "Iowa Plan:" "It should be read and studied by every teacher and principal who would have a thorough understanding of this question."

The International Sunshine Department for Blind Babies and Backward Blind Children, 96 Fifth Avenue, N. Y., requests that it be informed by any one who knows of blind and backward young children. To date only four states pay $1.50 per day for the care and education of such unfortunates.

AMERICAN ASSOCIATION OF PSYCHIATRIC SOCIAL WORKERS

The Section on Psychiatric Social Work of the American Association of Hospital Social Workers formally disbanded at its fourth annual meeting held at Cleveland on May 26, 1926, and a new independent organization, the American Association of Psychiatric Social Workers, was formed. The new Association realizes that it has been of inestimable value during the period of initial growth to have been affiliated with the larger, well-established professional group of hospital social workers, and does not expect that the separation will lessen the coöperation between the two bodies.

At the general session that followed, the subject "Some Recent Experiments among Psychiatric Social Workers" was presented by five Section members who have undertaken work in new fields. The studies reported, the discussions and the recommendations in the president's annual address are certain to be of interest to students of Applied Psychology.

The officers of the new Association are: Mrs. Maida H. Solomon, Boston Psychopathic Hospital, President; Miss Kathleen Ormsby, National Committee for Mental Hygiene, New York City, Secretary-Treasurer.

RESEARCH ON SLEEP

In 1924 the Simmons Fellowship was founded at Mellon Institute of Industrial Research, University of Pittsburgh, to carry on a broad study of problems in the promotion and maintenance of healthful sleep. Dr. H. M. Johnson and Mr. G. E. Weigand, psychologists, and Dr. T. H. Swan, physical chemist, have been conducting this research during the past year. Recently Dr. Carney Landis, physiologist, has temporarily joined the personnel of the investigation. It is announced that from now on there will be two separate Simmons Fellowships at Mellon Institute. One of them will continue the research on the physiological and psychological factors of sleep under the supervision of Dr. Johnson. The other Fellowship, held by Dr. Swan, will be concerned chiefly with the subject of bedding materials. This investigational work is being supported primarily for the benefit of the public and consequently the experimental results will be published.

BOOK REVIEWS

PAUL C. SQUIRES. *A Universal Scale of Individual Performance Tests.* Examination Manual. Princeton University Press, 1926. Pp. 158.

This volume constitutes Part One of a monograph that reports a project undertaken by the writer at Princeton University during the years 1923 to 1925 under an appropriation made by the Committee on Scientific Problems of Human Migration, of the National Research Council. Work on this problem was carried on under the direction of Professor Carl C. Brigham. Part Two of the monograph is to be devoted to the discussion of the results obtained by the application of the scale.

The writer states that he has attempted to construct a scale of individual performance tests that will completely dispense with the use of language, that will differentiate within the upper as well as within the lower ranges of intelligence, and that may be applied to any individual whatever, irrespective of race, nationality or culture. To what extent he has succeeded in this attempt it is impossible even to hazard a guess until the data obtained by the use of the scale are available.

There are fourteen tests, described in detail in the following order:

1. Series Forward Test
2. Single Cube-piles test
3. Association Test (Pictorial)
4. Association Test (Quantitative)
5. Arrangement of Cube-piles Test
6. Painted Cube Test
7. Series Reversed Test
8. Association Test (Geometric)
9. Block Construction Test
10. Picture Analysis Test
11. Reasoning Test
12. Free Analogies Test (Pictorial)
13. Spot Pattern Test
14. Right and Left Hands Test

Although much of this material was suggested by the work of earlier investigators, the tests in their present form will probably constitute a valuable addition to the stock of performance tests available for the testing of intelligence. The time required to give the complete scale averages about three hours and a quarter. This, together with the

somewhat elaborate apparatus and procedure may tend to limit the use of the scale in its present form.

Creative work is slow and difficult. There are many false moves. Much effort is apparently wasted. It is only when we are completing a project that we can see how to begin it. Although, without any data at hand, it is impossible to evaluate the work reported in this monograph, the reviewer has the impression that an excellent piece of preparatory work has been accomplished, and that the writer is now in a position to attack the problem of constructing and standardizing a scale of individual performance tests that will satisfy practical requirements as to time and simplicity, without sacrificing any of the advantages of the scale in its present form.

GRACE ARTHUR,
Child Guidance Clinic, St. Paul, Minnesota.

HARRY HELSON. *The Psychology of Gestalt.* Published by the Author, Urbana, Ill., 1926. Pp. 131. $1.50.

This monograph comprises the author's four papers on Gestalttheorie which appeared originally in the American Journal of Psychology, vols. 36–37. They represent the substance of Helson's dissertation, completed at Harvard in 1924. The first three papers deal with the problem, method and some experimental results abstracted from the works of the leading exponents of the theory. In the last paper Helson presents his own opinions in a critical review of the principles of Gestalt. The pagination of the reprinted papers is retained in the monograph.

The reviewer is convinced that this monograph is deserving of a wide and critical reading, particularly by those who are now struggling in the winter of their psychological discontent with both traditional and current systems. Helson's papers present the best exposition to date in the English, doubtless, of the *Standpunkte* of the Gestaltists. However it is questionable whether there is as general agreement among the exponents of this view as the reader is likely to infer—particularly where fundamental issues are involved. Aside from the Graz school, there are serious differences in the systems of Wertheimer, Köhler and Koffka which are evident in their original papers, more so than in Helson's monograph.

In addition to his exposition of Gestalt the author is impelled to express his dissatisfaction, in almost every section of the monograph, with the systems which he designates as associationism, introspectionism and behaviorism. His attempts to castigate "the behaviorist" are weak and inaccurate and seem to be based on nothing but a displeasure with Watsonian doctrines of 1919 and earlier. He charges "the behaviorist," "if there are any thoroughgoing behaviorists left

(p. 350)," with the same Robackian offenses as of old, namely, "dogmatism" (p. 197), "throwing the baby out with the bathwater" (p. 62), making Thorndike a behaviorist (p. 349), "attempts to reduce *meaningful* responses to unit (meaningless) reflexes" (p. 195) and that the "selection" in the "learning" of skillful acts is by "blind chance" and "stark mechanism" (pp. 44 et seq., 62).

The net result of this Quixotic foray detracts from and is irrelevant to the otherwise positive assertions in behalf of the Gestalt attempt to get a monistic science, in which there are no breaks between the artificial divisions which we call, academically, physics, physiology, neurology, etc., and yet (for psychology at least) to avoid giving up the mentalistic ghost by calling it by such terms as "phenomenal fields," "experimental data" and the like (pp. 514–515).

The problem of Gestalt psychology as Helson envisages it is "to steer between the blind mechanism of the frequency and conditioned reflex theories and the vitalism of Bergson, Driesch and others" (p. 44). Factually this is not *problem* at all, but an aspect of method. We read that "the aim of the configurationists . . . . has been to account for phenomenal patterns by means of configurational processes in the nervous system without any break in theory" (p. 515) and that "the configuration in its broadest sense . . . . means no more and no less than the totality of conditions both outside and inside the organism" (p. 505). Also that "the past, present and *future needs* (Italics mine) of the organism combine to modify every single act in the economy of the whole" (p. 42) and that "the end is the controlling factor in everything the ape does" (p. 45). This sounds like pure teleology. There is no hint, in the monograph, as to how *future* needs (i.e., stimulating conditions) can excite *present* receptors.

On p. 48 we read that "if an animal cannot survey the whole situation in which his problem is enmeshed, the result will be a chance performance and a smooth learning curve." This is not clear; particularly the words "chance" and "smooth."

On p. 197 Helson states that "the configuration rests upon the usual view of (relatively) independent systems." Köhler has repeatedly emphasized the fact that Gestalten are "differential *dependencies* in equilibrium distributions of wider area." Again on p. 192 "in so far as they (Gestaltists) reject *all* analysis . . . . I must part company with them." The quarrel is not with analysis *per se*, in any of the five types enumerated by Köhler, nor in the use of any or all of these in the search for "real units" but in the abusive laxity which makes the analytic derivatives *malapropos*. It is the "reification" of the products which is at fault.

The treatment of the principles of "closure," the "copy" theory, the *transponierbarkeit* of Gestalten, "insight," the processes of *Nivel-*

lierung, Prägnanz, pure phi, and "learning" deserve an extended consideration which space forbids here. This adds weight to the advice to the reader of this review to read carefully Dr. Helson's well written monograph. Its faults are small compared to its contribution. While Gestalt psychology doubtless has much of value for American Psychology yet the rule of *caveat lector* is a good one to follow. Gestalt phenomenology is not psychology. The merits or defects of the system will "come out in the wash" of future experimentation.

SAMUEL RENSHAW,
Ohio State University.

ARTHUR JORDAN BREWSTER. *Introduction to Retail Advertising.* A. W. Shaw Company, 1926. 319 pp.

The author states that he has endeavored to write a book that will be helpful to retailers and serve as a textbook in schools and colleges, the former purpose being the more fundamental one. He begins with a general survey of the field of retailing. A very readable and interesting discussion of some of the newer problems of the retailer, due to changing conditions in present-day life, forms a part of this survey.

The treatment of copy-writing may be characterized as direct, clear and practical. That advertising should grow out of merchandising and store activities is the thesis upon which the principles of copy-writing are based. Type, layout, and illustration are handled in a manner designed to meet the needs of the small advertiser who has had little experience in getting advertising material ready for the printer. Type faces and measurement, printing processes, how to lay out an advertisement, and the more important processes used in reproducing illustrations are included in this division of the book. Following sections deal with the various advertising media and the adaptation of advertising to special forms of retailing. The concluding division is devoted to coöperation presenting such subjects as helps from manufacturers, coöperative retail advertising, and the need for truth in advertising.

The book is well illustrated with cuts and figures. Principles are made concrete by the description of actual procedure in the advertising campaigns of various successful stores. Sources of information such as various bureaus are cited and nontechnical methods of conducting individual investigations are given.

The author's occasional reference to psychology may be regarded as unfortunate. His list of instincts is especially open to question. It is to be deplored that writers in this and allied fields seem to think it necessary to drag a certain amount of psychology into their books, however much beside the point their use of it may be. Otherwise the author has succeeded unusually well in omitting all that is academic and narrowly theoretical. The omission of statistical methods from

the discussion of investigations may not meet the approval of all, but it is entirely defensible in a book meant to serve as a practical guide in this field. In no way unusual in its outline, it is in the tying up of principles with practical concrete situations that the book's distinction lies. It is admirably suited to the purpose for which it was written.

AMOS C. ANDERSON,
Ohio University.

WILLIAM SCOTT GRAY. *Summary of Investigations Relating to Reading.* University of Chicago, Chicago, 1925. 275 pp.

This monograph contains a summary of investigations relating to reading which were made in America and England prior to July, 1924. It also contains a reference to some studies carried on in Germany and France.

The summary is made under sixteen different topics thus making its contents readily accessible to the student. There is an attempt to group under each topic the significant facts relating to it. Each chapter opens with a statement of the problem and concludes with a brief summary of the topic.

The monograph contains an annotated bibliography of four hundred thirty six titles. It closes with a fairly complete index.

The same author has continued the service rendered in the monograph by making a summary of reading investigations appearing between July 1, 1924, and June 30, 1925. This summary is found in The Elementary School Journal for February, March, April, and May 1926.

Such service as is rendered by the *Monograph* and series of articles appearing in the *Journal* will materially aid in unifying our thoughts relating to the problem of teaching reading.

MARTIN J. STORMZAND AND M. V. O'SHEA. *How Much English Grammar?* Warwick & York, Baltimore, 1924. 224 pp.

For many years our teachers have been striving to learn how much English grammar should be taught to the children in our schools. In the monograph by Stormzand and O'Shea, we have at least a tentative answer to the question. They have attempted to apply two criteria in an endeavor to select the grammatical topics that should have consideration. These two criteria are the complementary principles of usage and error.

The authors have examined ten thousand sentences selected from a wide range of material. This material includes sentences from standard prose, light fiction, editorials, business letters, and school compositions. It was the endeavor of the authors to select the sentences from representative sources.

These ten thousand sentences were analyzed to discover the frequency

of the different grammatical topics and the errors occurring in their usage. The topics under which the analysis was made were those most frequently found in our text-book on English grammar. The topics used include sentence structure, clauses, phrases, parts of speech, and uses of nouns, pronouns, verbs, adjectives, and adverbs.

In presenting the results of the analysis, numerous tables and diagrams are used. These tables and diagrams show not only the distribution of topics according to *material* but also, according to the *school level* of those supplying the composition material. This two-fold distribution of the grammatical topics often yields results exceedingly significant. This is especially true when we take into account the frequency of errors found in the use of the same topics.

The conclusions from the data recorded are to say the least extremely suggestive of certain important, if not imperative modification of our courses in English grammar. The method used by the authors will no doubt be found defective in certain particulars and some of the conclusions based on the study will be found to be erroneous. However the study is of sufficient worth to warrant its further pursuit with the hope that a rational and useful selection of topics may be forthcoming for use in our courses in English grammar.

WILLIS L. GARD,
Ohio University.

W. I. HAMILTON. *Employer-Employe Relations in Hotels.* The Williams & Wilkins Company, 1925. Pp. xii + 158.

The former director of the Research Bureau of the American Hotel Association tells how hotels are using and should use personnel methods comparable to those used by other large business enterprises. In part the book brings together in accessible form a series of articles published in the Hotel World. Managers and department heads of hotels for the first time have available a summary of the methods "for securing and maintaining a satisfactory and satisfied corps of workers' in their business. Here is a field with over three billion dollars invested in which personnel problems are certainly most urgent. Hotel employes traditionally include a large group of "roamers." The turnover, however, is not limited to the semi-skilled. If the statement of one hotel training school is to be trusted, the annual change of managers, housekeepers and chefs costs the hotels nearly four million dollars. Four chapters on training in hotels are particularly suggestive. With the exception of pensions, all the "fifteen good roads to good will in industrial relations" listed by the Metropolitan Life are found in hotels and described briefly. No hotel, however, has a properly functioning centralized personnel division, although some use the title of personnel manager. The author is familiar with the best personnel methods and

makes helpful suggestions which are illustrated by concrete examples. When information is lacking, it is the fault of the business which is just beginning to give more systematic attention to improving its personnel. Its vaunted service to the public is rarely backed by corresponding interest in service for its own employes, although instances of notable achievements are described. Hotel men will surely find this authoritative review a pace maker. The publisher's attached list of its employes who made the book invites imitation.

J. B. MINER,
University of Kentucky.

M. E. HERRIOTT. *How to Make a Course of Study in Arithmetic.* Urbana, Illinois: University of Illinois, Educational Research Circular No. 37, 1925. 50 pp.

"The purpose of this circular is to indicate the application to arithmetic of the general technique of course-of-study making. The circular is intended to furnish a working basis and a guide to those who are making or revising the course of study in arithmetic" (p. 3). A general outline for an arithmetic course of study for the six grades of the elementary school is provided and the separate divisions of this outline are then discussed in some detail. The author has consulted a wide range of references and cites authority for most of the recommendations offered.

In the Appendix, which is somewhat longer than the main body of the pamphlet, a detailed course of study for grade IV is given to illustrate specifically the application of the principles previously discussed. The pamphlet includes a good annotated bibliography. This bulletin should be useful and valuable to teachers, superintendents, and others interested in the construction of a course of study in arithmetic.

R. L. MORTON,
Ohio University.

WILLIAM C. BAGLEY. *Determinism in Education.* Baltimore, Warwick and York, 1925. 194 pp.

The papers of Professor Bagley on what he believes to be deterministic trends in education, particularly in the uses and interpretations of "intelligence" test data, are so well known that a review of his book, *Determinism in Education*, may seem to be neither necessary nor justified. In this volume he has brought together, with some modifications and additions, his writings and public utterances on this subject for the four-year period ending early in 1925.

Most of the readers of this review probably have read these papers as they have appeared in educational periodicals; several have listened to one or more of the public addresses. It was the reviewer's good for-

tune to hear the address at Chicago in February, 1922, and also that at Columbus in May, 1923, as well as to read these and other papers as they became available.

To read what Professor Bagley writes is to be forcefully impressed with the clear vision, the almost invulnerable logic, and the excellent scholarship of the writer. To hear him speak is to be rendered veritably immobile and incapable of rejoinder, as has been demonstrated on more than one significant occasion. Courageous, indeed, is he who would debate in public the deterministic issue or any other issue with Professor Bagley.

But so replete with moot questions is *Determinism in Education* that an adequate review could hardly be undertaken in less space than was required for the book itself. The author holds that leaders in the field of intelligence measurement have ascribed too much of the individual's performance on an intelligence test to innate factors which "in themselves are practically unmodified by experience or training," that the innate factors which have been called "general intelligence" have never been clearly defined; that the facts do not justify the conclusions which the "determinists" have drawn but may quite as well or better support conclusions of an entirely different kind as to the effect of education upon one's intelligence; that growth may be both *vertical* growth, which may be definitely limited by one's inheritance, and *horizontal* growth which may continue through the life of the individual, *intellectual* growth being made up of both these types; and that the deterministic assumption, if generally accepted, would work havoc with our democratic ideals of social organization and control. There are many other contentions in the book but they seem to the reviewer to be subordinate to those which have been enumerated.

But few educators will refuse to grant that Professor Bagley has done a masterful piece of work in pleading his case. His utterances, too, have probably been timely and have doubtless had a sobering and steadying effect upon aggressive individuals who have been enthusiastic over the valuable offices of intelligence tests. His remarks have been disputed most vigorously and in greatly varying fashion; that was to be expected. Any other result would have been a surprise and, perhaps, a disappointment to him.

However, Professor Bagley's equal in logic and argumentation, if such exists, might be expected to make as strong a case against his claims as to the influence of schooling on intelligence as he makes against the determinist's contentions relative to the importance of the hereditary factors. After presenting and discussing his data, with heavy emphasis upon correlations, he draws rather sweeping and very emphatic conclusions. He states that he has "demonstrated that differences found among the median scores of contingents of recruits

from the American states can be *amply explained* in terms of the educational facilities afforded by these states" (p. 122); that "the validity of the Army tests as measures of native intelligence-levels . . . . *has been proved to be a fallacy*" (p. 129); and that "the constructive program of the rational equalitarian" (p. 129) "cites the investigations which *prove beyond cavil* that schooling exerts a positive and powerful influence in stimulating the growth of native intelligence" (p. 130).[1] To present correlations between test scores and educational ratings of states as proof or ample explanation of the *causes* of those scores is to ask for a very liberal definition of "proof." That "correlation does not guarantee causation" is a statistical truism; yet "It is the contention of the writer that the studies reported in the present volume have overcome many if not most of the difficulties involved in distinguishing causes from concomitants in this complicated field of investigation" (p. 162).

Professor Bagley seems to have derived much satisfaction from Burt's study which resulted in the claim that "mental age" upon analysis turned out to be 33 per cent native intelligence, 11 per cent informal education and 54 per cent formal education (pp. 18, 76, and 134). It is unfortunate that someone had not indicated to him what many saw and what Messrs. Holzinger and Freeman very effectively pointed out,[2] viz., that the use of regression coefficients as percents is statistically unsound. Burt made the unfortunate blunder of assuming that these coefficients could be interpreted as percents because they happened to add up to approximately unity.

The author claims that present-day intelligence levels as shown by Army tests are clearly caused by the schools of the day when the drafted men were pupils. But these schools were established or supported by the parents of these pupils; they probably reflected their own intelligence levels in the quality of educational facilities which they furnished. Hence, the futility of interpreting correlation as causation.

The reviewer is glad that Professor Bagley has devoted a portion of his book to replying to his critics. He regrets, however, that Bagley's former pupil, Truman L. Kelley, was neglected. Kelley wrote what in the reviewer's opinion is the sanest and at the same time the cleverest of all the criticisms of the Bagley-Terman controversy.[3] He suggests, on the basis of assumptions which do not seem to be unduly

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[1] Italics supplied.

[2] Holzinger, Karl J., and Freeman, Frank N. "The Interpretation of Burt's Regression Equation." Journal of Educational Psychology, xvi, 577–582, December, 1925.

[3] Kelley, Truman L. "Again: Educational Determinism." Journal of Educational Research, viii, 10–19, June, 1923.

naïve, that the stimulus which is of optimum value for an individual may be located above the individual's position on a native ability scale (perhaps one sigma distance above) and that the function of the teacher is to keep each of the greatly varying members of her group on his toes, as it were, in order that the maximum of benefit may be derived by each. Bagley contends that education is essentially a leveling up process (pp. 148–155). Kelley points out that "The only way to bring those of varying talent to a common level would be to give the dullards the optimum stimuli as judged by their talents, the medium somewhat less than the optimum as judged by theirs, and the bright much less than their optimum" (p. 16).

This review is becoming too long. The reviewer has said enough already to "get his foot in it." But he cannot close without reference to the author's definition of intelligence "as connoting the most important function of mind, namely, the ability to control behavior in the light of experience" (p. 157). He got a temporary thrill out of that for he thought the author would then define "mind," but was disappointed. The reviewer with his behavioristic leanings does not understand that definition. He wishes that Bagley would explain it.

R. L. MORTON,
Ohio University.

NEW BOOKS AND PAMPHLETS RECEIVED*

Books and pamphlets for reviews should be sent to James P. Porter, Department of Psychology, Ohio University, Athens, Ohio.

The Art of Seeing. CHARLES HERBERT WOODBURY AND ELIZABETH WARD PERKINS. Charles Scribners Company. 290. pp.

Case Studies in Educational and Vocational Guidance. JOHN M. BREWER MABELLE B. BLAKE, AND OTHERS. Ginn & Company, New York. 243 pp.

Experimental Psychology. MARY COLLINS AND JAMES DREVER. E. P. Dutton Company, New York. 315 pp.

Finding the Right Teaching Position. HARLAN C. HINES. Charles Scribner's Sons, New York. 200 pp.

The Humanizing of Knowledge. JAMES HARVEY ROBINSON. George H. Doran Company, New York. Price $1.50. 119 pp.

Indiana Rural Education Survey Committee Report. March, 1926. GEORGE W. FREEMAN, Chairman. Wm. B. Burford, Contractor for State Printing, Indianapolis, Ind. 130 pp.

The Influence of Nurture upon Native Differences. TRUMAN L. KELLEY. Macmillan Company, New York.

Measurement of Intelligence by Drawings. FLORENCE L. GOODENOUGH. World Book Company, Yonkers, N. Y. Price $1.80 173 pp.

Psychology of Everyday Life. JAMES DREVER. Methuen & Company, London, England. 164 pp.

Psychology of Industry. JAMES DREVER. E. P. Dutton & Company, New York. 148 pp.

Psychology of Persuasion. WILLIAM MACPHERSON. E. P. Dutton Company, New York. Price $2.50. 256 pp.

Psychology of War. JOHN T. MACCURDY. E. P. Dutton Company, New York, 91 pp.

Pupil Adjustment. WILLIAM CLAUDE REAVIS. D. C. Heath & Company, New York. 348 pp.

Self Direction and Adjustment. NORMAN FENTON. World Book Company. Price $1.40. 121 pp.

University of Iowa Studies in Psychology, Nos. IX and X. CARL E. SEASHORE, Editor. Psychological Monographs Nos. 167 and 168. Psychological Review Company, Princeton, N. J. 264 and 112 pages respectively.

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* Mention here goes not preclude further comment.

Directory of American Psychological Periodicals

American Journal of Psychology—Ithaca, N. Y.; Morrill Hall.
Subscription $6.50. 600 pages annually. Edited by M. F. Washburn, K. M. Dallenbach, M. Bentley, E. G. Boring. Quarterly. General and experimental psychology. Founded 1887.

The Pedagogical Seminary and Journal of Genetic Psychology—Worcester, Mass.: Clark University. Subscription $7. 700 pages annually. Edited by Carl Murchison and an international co-operating board. Quarterly. Child behavior, differential and genetic psychology. Founded 1891.

Psychological Review—Princeton, N. J.: Psychological Review Company.
Subscription $4.25. 480 pages annually.
Bi-monthly. General. Founded 1894. Edited by John B. Watson.

Psychological Bulletin—Princeton, N. J.: Psychological Review Company.
Subscription $5. 720 pages annually. Psychological literature.
Monthly. Founded 1904. Edited by Samuel W. Fernberger.

Psychological Monographs—Princeton, N. J.: Psychological Review Company.
Subscription $5.50 per vol. 500 pp. Founded 1895. Ed. by Shepherd I. Franz.
Published without fixed dates, each issue one or more researches.

Psychological Index—Princeton, N. J.: Psychological Review Company.
Subscription $1.50. 200 pp. Founded 1895. Edited by Walter S. Hunter.
An annual bibliography of psychological literature.

Journal of Philosophy—New York; 515 W. 116th St.
Subscription $4. 728 pages per volume. Founded 1904.
Bi-weekly. Edited by F. J. E. Woodbridge and Wendell T. Bush.

Archives of Psychology—Sub-Station 84, N. Y.: Archives of Psychology.
Subscription $5. 500 pp. ann. Founded 1906. Ed. by R. S. Woodworth.
Published without fixed dates, each number a single experimental study.

Journal of Abnormal Psychology and Social Psychology—Albany, N. Y.
Subscription $5. Boyd Printing and Publishing Co. Edited by Morton Prince in co-operation with Floyd H. Allport.
Quarterly. 432 pages annually. Founded 1906. Abnormal and Social.

Psychological Clinic—Philadelphia: Psychological Clinic Press.
Subscription $2.50. 288 pages. Ed. by Lightner Witmer. Founded 1907.
Without fixed dates (9 numbers). Orthogenics, psychology, hygiene.

Training School Bulletin—Vineland, N. J.: The Training School.
Subscription $1. 160 pp. ann. Ed. by E. R. Johnstone. Founded 1904.
Monthly (10 numbers). Psychology and training of defectives.

Comparative Psychology Monographs—Baltimore: Williams & Wilkins Co.
Subscription $5. 500 pages per volume. Edited by W. S. Hunter.
Published without fixed dates, each number a single research.

Psychoanalytic Review—Washington, D. C.: 3617 10th St., N. W.
Subscription $6. 500 pages annually. Psychoanalysis.
Quarterly. Founded 1913. Ed. by W. A. White and S. E. Jelliffe.

Journal of Experimental Psychology—Princeton, N. J.
Psychological Review Company. 480 pages annually. Experimental.
Subscription $4.25. Founded 1916. Bi-monthly. Ed. by Madison Bentley.

Journal of Applied Psychology—Baltimore: Williams & Wilkins Co.
Subscription $5. 400 pages annually. Founded 1917.
Quarterly. Edited by James P. Porter and William F. Book.

Journal of Comparative Psychology—Baltimore: Williams & Wilkins Co.
Subscription $5. 500 pages annually. Founded 1921.
Bi-monthly. Edited by Knight Dunlap and Robert M. Yerkes.

Journal of Personnel Research—Baltimore: Williams & Wilkins Co.
Subscription $5.00. 500 pages approximately. Edited by Walter V. Bingham, Lewis L. Thurstone, and Clarence S. Yoakem. Monthly.

Genetic Psychology Monographs—Worcester, Mass.: Clark University.
Subscription $7. 600 pages annually. Edited by Carl Murchison and an international cooperating board.
Bi-monthly from January, 1926. Each number one complete research. Child behavior, differential and genetic psychology. Founded 1925.